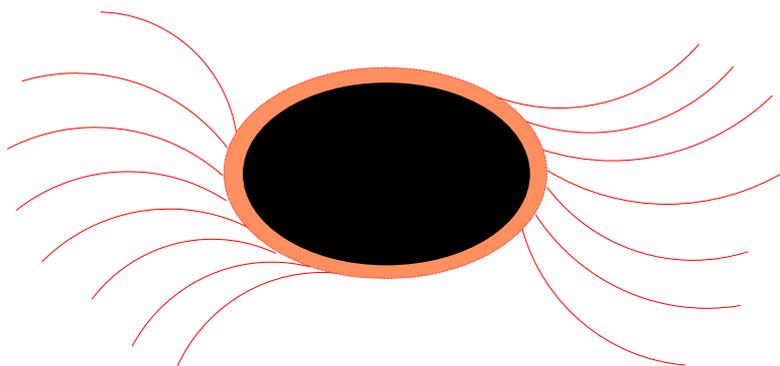


**The Theory of Vacuoles**  
**and**  
**Low-Energy Nuclear Reactions**



**The Correct System**  
**of**  
**Dimensions and Units**  
**Francis F. Pitard**

UPDATED September 15, 2016—Lithium Battery Problem (see [Section 10-8](#))

# The Theory of Vacuoles and LENR

Dr. Francis F. Pitard

Essay on the Fundamentals of Nuclear Physics

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Published by

Francis Pitard Sampling Consultants, LLC

14800 Tejon Street, Broomfield, Colorado, 80023, USA

[www.fpccsampling.com](http://www.fpccsampling.com)

ISBN-13: 978-1530281718

ISBN-10: 1530281717

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I dedicate this book to my good friend, the late Charles Oliver Ingamells; without his work this book would never have existed.

## PREFACE

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**“Progress will not come from repetitive and meaningless experiments, but from audacious speculation.”**

**Albert Einstein**

The long march through this essay makes an attempt to correct for an unfortunate false negative induced by an overly conservative Establishment. It appears that we may have, inadvertently and out of good will, shut the door to a vast domain of science. We intend to demonstrate that matter is not what we think it is. By doing so, we reopen that door that was tightly closed for too long, and suggest that Low-Energy Nuclear Reactions (LENR) are far more frequent in nature than we ever dreamed and, therefore, relatively easy to induce, which has promising implications. It is time to tap in this vast area of science and, perhaps, save this planet from a doomed destiny: it is not too late, but, the clock is ticking. The approach we suggest is new, provocative, but scientifically wise and well substantiated, and most certainly leads to fascinating possibilities. The subject is not simple; otherwise, there would be no need for this essay. If we intend to offer the scientific community with a document deep enough to bring relevant new thinking, we must begin by cleaning the “kitchen” somewhat,

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realize some well-accepted foundations are not sacrosanct, so we can prepare our mind to look at the Universe in a very different way; only then, mankind may make that giant step forward.

There are flaws in standard models. All standard models have flaws. Flaws are not easy to find, otherwise they would not exist. Flaws in the current model are from a faulty dimensional system and, an irrational system of units, metric, international or not, that does not seem appropriate for advanced Physics.

Furthermore, life is a statistical accident, or is it? Research is to prove, rather than discover the cosmological constant. However, the wave-particle duality rejects truths that do not fit standard models. Confined in three dimensions, “progress will not come from repetitive and meaningless experiments, but from audacious speculation,” **liberating us from powerfully established paradigms.**

### **SPECULATION**

Speculation is defined as the contemplation or consideration of some subject; a conclusion or opinion reached by such contemplation.

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Most advances in the understanding of our world, our universe, have originated in speculation, usually inspired by dissatisfaction with currently accepted beliefs, axioms, or theories. There is a chain of events that must follow any scientific speculation, if it is to advance our perceptions or knowledge:

Speculation – Experimentation – Documentation – Acceptance

These days, in physical science at least, many of the required experiments have been performed: it is only necessary to glean information from libraries. Repeating well-established results is a meaningless waste of effort. Following experimentation in the library or laboratory, the budding work must be documented for consideration by others, especially those within the existing scientific Establishment, who still consider it with reluctance and suspicion, if they can be persuaded to consider it at all. This step is especially difficult if a favorite axiom or belief is endangered. The final step, acceptance, may come very slowly, very often not in the speculator's lifetime. Success of an important speculation may lead to the upset of many apple carts and much discomfort in powerful places. Excommunication, being sent to Coventry, and oblivion are the fates of many a speculator. These words are most appropriate today when many experiments have led to observations nobody can explain, and are listed under the names of "Cold Fusion" or "Low-Energy Nuclear Reactions." It is a time when acceptance cannot be reached, and this is because the existing

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stationary Establishment is not complete or, at least, something important is missing; we intend to fill that gap. The difficulty is that we want to see, touch, smell, taste, or hear things, otherwise they don't exist. But, apparently, what is missing has nothing to do with particles as we know them and, we are not prepared for that new, different view of the Universe.

The following work can be considered quite offensive for the scientific reader who spent a great deal of his or her life working in the domain of physics, especially as presented by my dear friend, the late Charles Oliver Ingamells who, during his lifetime, was never short of straight-to-the-point remarks when he reached a point where his patience was running short. As his daughter, Margaret I. Resnick said so well, "my father was an Einstein; and it is a shame that he was not more recognized. His genteel, selfless and aggressive desire to learn what's out there made him a valuable asset to the scientists who want to further mankind's sense of awareness." Personally, I fully agree with these words. But, as a man of great vision, he had no patience for people who are prisoners of short-sighted paradigms. Very often, when I first met him, I felt like "a monkey playing with a typewriter." However, with him, I learned fast. Another point I fully agree with Margaret Resnick is when she said, "my father was scientifically superior but diplomatically inferior!" Today, we all laugh about this,

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yet the reader may still sense this shortcoming in diplomacy throughout this essay. I made it a point to eliminate unnecessary negative statements and to transform them into more positive possibilities; but, it was not always easy to do without losing some of the important message.

The following work can be perceived as a deep criticism of the existing Establishment, especially nuclear physics, quantum mechanics, string theory, and even astronomy. But, I happen to have a good background in nuclear physics and I have a passion for astronomy, so I happen to see things from another perspective, more positive and constructive - perhaps. My dream is to make the reader of this essay comfortable with new ways of looking at the Universe in which we live. At the end of this journey, the reader may not agree with some of our arguments, especially those who will perform a peer review of this unique historical document; there is nothing wrong with that, if we intend to make progress. However, he or she will never think the same way again: this I promise!

It is indeed my view that the following work, **if taken in a constructive way**, can actually be a trampoline for today's nuclear physics, quantum mechanics, string theory, and astronomy to reach astonishing new possibilities, without, **and I**

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**insist on without**, challenging the acquired knowledge from so many talented scientists accumulated over the past 200 years, without whom this essay could absolutely not exist. To further explore the ideas exposed in this essay, it is a fact we must have a powerful background in physics and mathematics. Therefore, I am both excited and humble about the following work... still in its infancy, and yes there will be areas that will have to be improved.

At this early stage, the only thing it takes is a necessary shift in paradigms, from one paradigm for which we have been carefully wired for over 6000 years (i.e., looking at ourselves in a 3-dimensional universe) to another paradigm for which we are not well prepared (i.e., looking at ourselves as an intimate part of the n-dimensional Universe); this may not seem new to many, but there are deep subtleties in the following work that make it different and unique. As the reader will slowly progress through the text the argument should become self-explanatory, until we finally reach dramatic observations and provocative conclusions.

In other words, nuclear physics, quantum mechanics, string theory, and astronomy are a huge part of today's fundamental knowledge in physics. **Only a very deep reason, at the deepest roots of how we perceive the sub-quantic**

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**medium**, could explain why we may have to take a deep breath and completely rethink some of the assumptions that were used to wire our minds in the ways we think today. It is important to be humble about it and only look at the new possibilities. Along the way we will find out that we may have another serious problem with our existing systems of fundamental dimensions and units, **metric or not**: suggestions will be given as they were a natural by-product of our ways of thinking in this essay; this, by itself, should make the following work a cornerstone of a new way of thinking: **a much simpler, different, and deeper way**.

Some readers may also quickly remark, as some of my friends already did, that Ingamells's work was mainly done between 1950 and 1993, and they would say "Physics has come a long way since that time." This comment is not a valid one, because **the necessary shift in paradigm was never implemented**, regardless of the stunning progress we have made... In other words, we could have done better.

In a nutshell, the following work may greatly contribute to make everything simpler, leading to a better vision and most certainly new questions leading to many new possibilities. After all, we are all explorers; in this process we want to

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eliminate the thick fog of unnecessary complexity, and especially the long theoretical developments going nowhere because they are based on weak paradigms.

During a conversation about clarity principles suggested by Rutherford, Albert Einstein said to Louis de Broglie, “all physical theories, their mathematical expressions apart, ought to lend themselves to so simple a description that even a child could understand them.” Then, later in 1929, when he became dismayed by the suggestions of quantum mechanics he said: “Everything is determined, the beginning as well as the end, by forces over which we have no control. It is determined for the insect as well as for the star. Human beings, vegetables, or cosmic dust, we all dance to a mysterious tune, intoned in distance by an invisible piper.” In other words, make very sure your vision is based on a correct paradigm, then and only then, use mathematics as a penetration tool to explore that paradigm in greater depth. In the following essay, this principle is our motto and the reader will easily sense the strict discipline of it.

## ABSTRACT

---

This essay encompasses a vast domain of Nuclear Physics that brings us to the gates of very deep thoughts, questions, intriguing answers, fascinating observations, and troubling coincidences; yet, the new concepts are relatively simple to explain. The first part is dedicated to the introduction of the problem, to some giveaways that should have raised our curiosity far more in depth a long time ago. It also shows, beyond any possible doubt, that our current system of dimensions and units, metric or not, is not an appropriate tool for advanced Nuclear Physics; it is unnecessarily complex with foundations that are more emotional than scientific, probably due to the fact that some areas of physics were established by people who were reluctant to communicate with other branches of physics. The system is acceptable for our day-to-day lives, when we cook for the family, or work for the mining industry as we did, totally unacceptable when we explore what the Universe is. We suggest a simpler system that makes it easier to penetrate the subtle environment of which we are all part.

**We prove beyond any possible doubt that time, mass, permeability, and permittivity do not need units of their own. In the suggested new system,**

**all values for the “fundamental” physical constants are absolute, with the exception of the time-thickness constant. This alone eliminates unnecessary ambiguity and greatly simplifies our search for the ultimate truth.**

Then, the essay proceeds with the fact that everything we do and measure is based solely on the properties of our local 3-dimensional Universe. Ironically, in this essay we even try to explain complex thoughts on a 2-dimensional sheet of paper! Somehow, we have a very hard time to eliminate it from our way of thinking; we grew up with this. It limits us in a tremendous way; unfortunately, we were wired that way for many thousands of years, therefore it is extremely well anchored in our DNA. Yet, when we make an attempt to think in terms of a 4-dimensional Universe, which is actually relatively easy for some of us, or in terms of a n-dimensional Universe, which is far more challenging for most of us, we quickly realize something is very wrong, something big is missing and the paradigm in which we are badly trapped is our number one enemy; most certainly, it is the number one enemy for good science, and as long as we are not willing to change paradigm, Science will not progress as effectively as it should. The reason is simple: we are working hard with beautiful tools in Mathematics and Physics to explain “things” based on an incorrect paradigm. As

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a result, progress is very slow, vision is very poor, and the results discouraging to many talented people because we have to create too many imaginings to correct for the wrong paradigm; amazingly, it does not work too badly, thanks to many talented researchers; **nevertheless, we should not continue to work that way**

The new paradigm starts with an audacious speculation, but proves itself rather quickly to become an interesting hypothesis, and this is where Charles Oliver Ingamells, the long gone exceptional chemist, left his unfinished work. Taking a new look at his work, 16 years after his death, and placing new observations, speculations, and hypotheses side-by-side leads to a series of coincidences, some of them already addressed by Ingamells long ago. However, the key coincidence that has enormous weight in this essay is the speculation that positrons and protons may have something in common. Positrons strangely disappear from our 3-dimensional horizon; however, protons are everywhere as a fundamental building block of the Universe, just like electrons. Then, how is it conceivable that protons and electrons may be distributed throughout the Universe in almost equal amounts? Coincidence! Furthermore, why is it that the electric charge of a positron is exactly the same, though opposite, as the one of a proton? Coincidence!

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A new view of the 4-dimensional, or n-dimensional Universe, leads to the necessary notion of vacuoles; putting it in a different way: we are not us, there, watching something else called the 3-dimensional Universe; we are the 4-dimensional Universe, or n-dimensional Universe, **capable of Universal Entanglement**, which opens immense new possibilities, vastly underestimated for much too long, no wonder we only use 10% of our brain's capabilities.

Then, using the Theory of Vacuoles, we explain why some isotopes are stable and why some are not. But, maybe there is no such thing as a clear separation between those that are called stable and those that are not; which, indeed may have important implications to our better understanding of Low-Energy Nuclear Reactions (LENR).

At the end of this essay, we may prove beyond any possible doubt that positrons and protons are exactly the same thing. A positron is what it is, an anti-electron, when we look at it within our usual 3-dimensional Universe. A positron is definitely a proton, if we start looking at it within a 4-dimensional Universe or n-dimensional Universe.

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Then, and this is the unexpected conclusion of this essay, using the Theory of Vacuoles we can clearly explain why the proton is **apparently** 1,836 times heavier than the electron or the positron. The coincidence is so shocking that it tells us we have, indeed, reached what we were looking for, a very valuable, final proof hidden within complex multi-dimensional subtleties.

It is rather obvious the essay has some weaknesses because the subject is so vast, so challenging, and so full of mysteries for a couple of mortals. Nevertheless, the objective is to start rolling the ball toward a new way of thinking that has been overlooked for too many years. The time is ripe to have the courage to change paradigms: it is never simple for many people, regardless of how talented they are. But, it is certainly worthwhile, and it is Science at its best. Furthermore, it may give us an attractive opportunity to save our world from global warming, at least until we are capable of creating new worlds on our own.

## **INTRODUCTIONS AND HISTORICAL SYNOPSIS**

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I truly wish Oliver would still be alive to contribute to the new version of this book and be a co-author with me. But, I make a point to preserve everything he has done, so he still can inspire many. Again, without him, this work could never have been done.

### **CHARLES OLIVER INGAMELLS CURRICULUM VITAE**

Charles Oliver Ingamells passed away in April 1994. During his later years, at his retirement home in Florida, he was a faithful representative of a group of well-known world experts in Sampling Theory, such as Pierre M. Gy, Francis F. Pitard, Jan Visman, Paul Switzer at Stanford University, and J.C. Engels of the U.S. Geological Survey, and the Linus Pauling Institute in Menlo Park, California. His association with Francis F. Pitard, during several years at Amax Extractive Research & Development, in Colorado, has added to a unique combination of different experiences in the field of geochemical analysis. His pioneering work in the field of geological sampling has led to collaboration with the above experts. Mr. Ingamells received his BA at the University of Western Ontario and his MS at the University of Minnesota.

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### **Introduction from Charles Oliver Ingamells, CIE, BAsC, MS, MM, ILI, RPCV**

This introduction is Francis Pitard's composite of Oliver Ingamells's notes and letters, to accommodate the purpose of this essay; I did my best for my fascinating friend.

This project began in the 1930's (Oliver talking in 1994); since then I have tried to keep up with the progress of "particle physics" and have felt increasingly dismayed as the ship has veered off course, abandoning rational imagery in favor of increasingly meaningless self-perpetuating imaginings. I have looked for those who have had the courage to attempt to introduce counter-revolutionary perceptions, often at high personal cost. I have begun an attempt to persuade some of these to abandon their differences, ignore the other fellows' naivety and shallowness, look at bizarre ideas, and begin to do what has been done before and what must and will be done sooner or later; withdraw from the swamp we are in, and search for the correct upstream tributary of the river, one that leads to the source we all seek.

Supercolliders are not the answer! We are advised to reexamine the foundations of the scientific and philosophic edifice we have inherited, instead of building

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grander imaginings on such a primitive foundation. Our political climate makes such a project immediately undesirable. Nevertheless, only disaster can come from a failure to examine the foundation before implanting heavy furbelows on an imperfect structure. There are among us those who perceive the flaws in the structure on which we build. We are advised to refrain from insulting and rejecting them. Listen to them! One or other of them may rescue us from the swamp in which we flounder.

Many brilliant scientists have one thing in common in their writings; they are uncomfortable with at least one feature of “standard models” of the Universe and its parts, just as Newton, Gauss, Galileo, Einstein and many others were not very satisfied with the perceptions of their days; and really, there is nothing wrong with that concept.

Some of our speculations are not very welcome within the Establishment! I am sure you have noticed this! Why? I think there are two reasons:

1. Any idea that does not fit well into a painstakingly developed thought pattern must have something wrong about it; it appears as a lack of understanding or competence or both.

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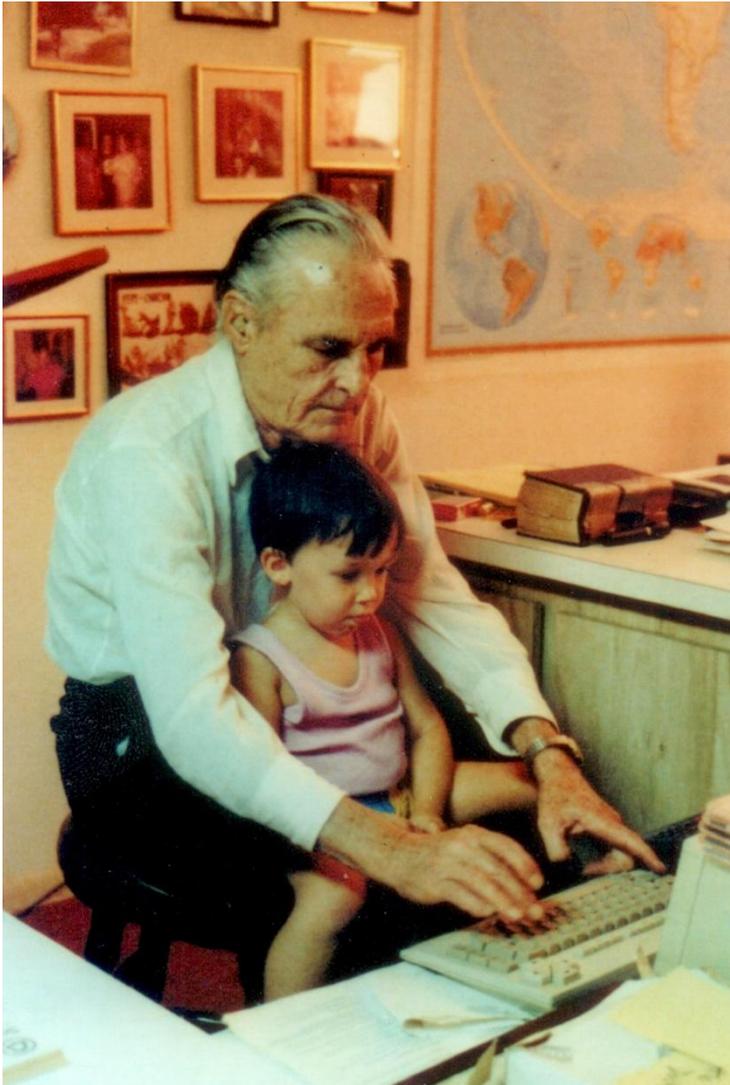
2. If it reveals a glimmer of truth, it endangers the personal life style of myriads of the faithful, most of them intellectually incapable of seeing the whole picture, or, if capable, personally unwilling to change.

Thus, it was between Galileo and the Pope, between Pasteur and Paracelsus, Einstein and Newton, De Broglie and Heisenberg! There is much good sense in all of our perceptions. The revolution, the fundamental change, the beginning of a new height in human understanding, inevitable, but now "on hold," can start only when all our imperfect ideas (Sorry! Nobody is perfect!) are stirred together in the same pot!

All advances in human knowledge and perception have come from someone who stirred up a mixture of contradictions and resolved them into a unified whole. That is what I hope we can all do. You have my contribution.

In other words, this book is just a new beginning and certainly not an end.

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**Oliver showing the subtleties of a 1993 world  
to his grandson Sender.**

## **FRANCIS F. PITARD CURRICULUM VITAE**

Dr. Francis F. Pitard is a consulting expert in Sampling, Statistical Process Control (SPC), and Total Quality Management (TQM). He is President of Francis Pitard Sampling Consultants ([www.fpccsampling.com](http://www.fpccsampling.com)) and Technical Director of Mineral Stats Inc. (MSI) in Broomfield, Colorado, USA. He provides consulting services in many countries. Dr. Pitard has six years of experience with the French Atomic Energy Commission and fifteen years with Amax Extractive R&D. He taught Sampling Theory, SPC, and TQM for the Continuing Education Offices of the Colorado School of Mines, the Australian Mineral Foundation, for the Mining Department of the University of Chile, and the University of Witwatersrand in South Africa. He has a Doctorate in Technologies from Aalborg University in Denmark.

### **Comments from Dr. Francis Pitard**

My relationship with Oliver has always been a very close one. When he passed away too early, I intuitively perceived he was looking to me as the one who would, one day, transmit his message to others. I was first humbled by the idea because Oliver was one of these rare human beings, who transcended millions of others with an intellect far greater than anyone can imagine. His ideas did not materialize into an impressive set of mathematical models; his ideas are visions

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you can reach only when the brain works at the limits of the Universe as we know it; which is a subtle difference that Einstein knew very well. The beauty of his unclouded mind was that he instinctively objected to false axioms and to unnecessary complexity that can only obscure the truth we all seek: I should say he was a master at this.

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**Francis F. Pitard**

**Introduction from Francis F. Pitard, Doctor in Technology from the Aalborg University in Denmark**

The year 2007 was a mile stone for me as I reached serenity in my way of looking at the Universe and, in the most unexpected way, this was one of the unpredicted consequences of the subject matter of this essay. Such a statement should never be taken lightly. I always had a deep interest in ancient Polynesian migrations in the South Pacific and also their very different philosophy of life, which made them participants in their world instead of observers, as we are too often in our materialistic world. I was writing the conclusion of my first historical novel, *Heirs of a Lost Race*, which was followed by the sequel *Rapa Nui Settlers*, when it became overwhelmingly clear that *Light*, in a broad sense, was something we have been ignoring for much too long. We could better define *Light* as the omnipresent *Ether*, but a faithful scientist may have a problem with either name and the way they are used, the former being too religious in nature and the latter being banished from the world of good science as being too speculative or even an unwelcome part of some kind of “voodoo” science.

When you reach that point in your life, thousands of events literally explode through your mind, as suddenly everything starts to make a lot of sense; of course, a lot of sense to you but not necessarily to others. Then, the following

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step quickly came: how can I share this with others, as it is so deep and at the same time so simple? You can talk about it forever, but words go with the wind and are lost; the necessary reach is just not there with only words. Therefore, writing this essay was the logical thing to do. There is probably nothing as hard to do as to write an essay on a subject you are in the process of exploring for yourself. But, this is precisely the kind of person I have always been: I said to myself I will do it because it is hard. If it was not hard, there would be no need for such a document. Ideas I will give, so other people can pursue them and reach more discoveries in territories, in which I am completely ignorant. Mistakes I will make, so people smarter than me can correct and suggest better ways. Criticism is always welcome when the suggested alternatives are better, as long as we are capable and willing to break the paradigm we are trapped in and that limits us in an unfair way.

It all started when I was seven going to catechism every Saturday morning at the church in the little village of Forcé, where I lived in 1949 and its 110 inhabitants, in Mayenne, France. Faithfully I learned my lessons every week and carefully listened to the message from the Catholic priest. By all means, he was a good, old, honest man. Like everyone else, I was taught to recite my prayers with other people. But, for many years, when I was alone in a church, or walking

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in a forest, or watching water falling from a dam as I was fishing, or watching timeless waves pounding on a beach, or watching song birds busy in their universe, or even admiring a red Amanita mushroom on a green carpet of forest moss, I always questioned the sanity of becoming a reciting robot. As young as I was, it was already clear in my mind the routine of the words was interfering with my communication with *Something Superior*, which I intuitively knew was an intrinsic part of me somehow. "Don't let school interfere with your education," Mark Twain said once. All my life, I strongly believed this communication was a private experience where nobody could tell me what to do or not to do and what to say or not to say.

I was not happy to be told what to think; I was thirsty to learn how to think; naturally, as a predictable result, I was always considered an average student, because the way things were taught to me were boring and, as a result, I would work just enough to get by with acceptable grades, and then swallow books in libraries that were totally unrelated to my assignments. There was something in me, something extraordinarily private and powerful, that no one would ever know. It was like a secret, sacred part of me that I have yet to completely understand. Even today, that belief is becoming even stronger in my mind. With all due respect to the priests who gave me a good education, there are

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territories where nobody can interfere with who you are; no priest, no mentor, no politician, no leader, no lawyer, no parent, and even no friend. These territories are in you and belong to the *Universe*. Of course you can, and must share experience, ideas, and innate wisdom with others, especially your spouse, your children, your friends, and everyone you love. They love you, but they also silently realize there is something in you genuinely good and peaceful they cannot describe; it is a secret territory where nobody has access.

The first thing I learned from this inward experience is that man-made religions are too often created to control other people in search of power for a few; that should sound familiar I am sure. A typical example of that was the Roman Emperor Constantine the Great, but we could list many thousands of others; the reason I selected Constantine the Great is because his authoritative and deterministic choice has influenced billions of people ever since.

The second thing I learned was that human kind created its own hell by following these power-thirsty extremists who are incapable of thinking in a peaceful way, and even incapable of loving; they don't know what love is.

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The third thing I learned is that we make things much too complicated, creating a swamp in which our soul flounders with no end in sight, philosophically, psychologically, religiously, scientifically, and socially speaking.

The fourth thing I learned is that there is no such thing as birth and death as the “*stuff*” of which we are made is eternal and a bizarre form of universal consciousness we still have a problem to identify; matter as we know it, the only thing we think there is, is not at all what we think it is, even with our most scientific advances of the 21<sup>st</sup> Century, which is the essence of this essay.

The fifth thing I learned is that we are given far more power than we may imagine through Universal Entanglement, if we were willing to look at who we really are at the sub-quantum level, from deep inside, and this made me instantly a very humble man.

## LIST OF ABBREVIATIONS

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A list of the principal notations often recurring throughout the essay is given. Along the way there are more notations that are defined as needed and used only in a short discussion. Some of these notations are selected for the sake of historical consistency.

### Latin Letters

$a$	Semi-axle of any spheroid
$a_o$	Radius of the unexcited (Bohr) hydrogen atom
$b$	Semi-axle of any spheroid
$c$	The speed of light
$C_u$	Thermal capacity per unit mass
$e$	Electron charge – Also used for the eccentricity of any spheroid
$E$	Potential difference
$F$	Faraday
$g$	Acceleration
$h$	Planck constant
$H$	Magnetic field strength
$I$	Electric current

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$k$	Boltzmann constant
$K$	Thermodynamic temperature
$\ell$	Mean free path
$L$	Length
$m$	Magnetic moment
$m_e$	Electron rest mass
$M$	Mass
$NU$	New unit
$p$	Gas pressure
$Q$	Quantity of electricity
$r$	Unit radius
$R$	Electric resistance
$S$	Unit surface
$t$	Time-thickness constant
$T$	Temperature – used also for time
$u$	Magnetic permeability
$U_b$	Bohr magneton
$v$	Mean velocity of molecules
$V$	Unit volume

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- $x$  Number of unit surfaces on any spheroid
- $y$  Number of unit volumes in any spheroid

### **Greek Letters**

- $\alpha$  Dimensionless fine-structure constant
- $\nu$  Frequency of a wave
- $\rho$  Density
- $\sigma$  Stephan constant
- $\gamma$  Surface tension
- $\lambda_c$  Compton wavelength
- $\pi$  Ratio of circumference over a corresponding diameter

## PART 1. THE BASIC APPROACH

---

### INTRODUCTION

Please, the scientists who know everything, the religious leaders who know the truth, and the capable philosophers who continuously change the world as we know it, keep it simple and quit wasting time arguing about one-sided visions. All close your eyes and **examine the 3-D universe from inside it, and not as though it is out there, outside our selves.** We are an integral part of the Universe, and it is mandatory to be so during our examination of its, our, properties; if successful at such a reversing exercise we may all find out we are **one** and nothing of what we see, touch, taste, smell or hear has anything to do with the real 4-D or n-D Universe; **it is a local, temporary illusion that does not mean anything.**

**Everything and, of course, everyone is one form or another of energy, all waves, and absolutely nothing else but waves travelling on a mysterious support.**

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Perhaps, this is why we love music so much! Perhaps, this is why we have such inner fascination, hard to explain, when we look at the stars. We are the music; we are the stars; therefore, it is well worthwhile to at least make an effort to look at ourselves in a completely different way.

Can such a proposal be done in a scientific way? Yes, it can!

## CHAPTER 1

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### THE VISION

The following carefully selected facts are all we need, as scientists, to realize something of great importance is missing in many of our analyses. It would be denial at its worse to pretend these facts do not exist and are the product of the author's imagination. The vacuole hypothesis presented in this essay invariably leads to attractive and powerful answers.

#### 1.1 THE FIRST GREAT GIVEAWAY

Once, I read the following experiment in a scientific magazine, which truly opened my mind. Two, so-called "photons," are created with an artificial crystal<sup>1</sup>. Each of them is sent on a fiber optic cable in opposite directions until they arrive simultaneously at a quantic gate. They can push the gate and select a short course or circumnavigate the obstacle by taking a longer course. Along the longer course interferometric mirrors guide the photons. The two quantic gates are about 10 kilometers apart. Statistically speaking and proven many times, if only one photon was sent in one direction, 50% of the time it would select the shortest course and 50% of the time the longer course. But, **when the two**

**photons, sent in different directions, arrive simultaneously at their respective quantic gate, they always make the same choice.**

This would baffle any scientist and especially any statistician. The photons act as if they could communicate in a mysterious, instantaneous way, **and obviously they do**. What is fascinating is that, under experimental conditions, in order to communicate, the message would have to travel ten thousand times the speed of light, which is baffling and clearly telling us **we are missing something of paramount importance**.

Similar experiments have been done in other laboratories around the world and they have reached similar conclusions. The following conclusions are absolutely unambiguous and unalterable:

- Photons, as we know them, do not exist, and, if they did, they would be strictly incapable of communicating at 10,000 times the speed of light.
- The so-called “photon” at one end, and its so-called “sibling” at the other end, are not separate entities but the very “same thing.”

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- It is a very tempting step to take an act of faith and say that the so-called “same thing” is conscious, capable of a decision, and therefore intelligent. Right there, this would indeed change everything, but it is not the objective of this essay to debate such a matter, at least not yet. Our objective is more modest: photons as we know them are waves, and waves only, with no material reality, travelling on a mysterious, universal support. That support, called *Ether* by many, and also abused in models as far back as the Greeks and all the way to the 21<sup>st</sup> Century, is the subject matter of interest. For too long we discarded it as a pure fantasy of our imagination; in a way it became the “forbidden” word, and yet it would be scientifically foolish to reject it on the basis that we do not understand it.
- Back to the above experiment, it is not the two photons at their respective quantic gate that make the same decision; rather and subtler, it is that single “same thing,” *Ether*, or whatever you may call it, that makes a decision valid at both quantic gates.
- The existence of *Ether* is a necessary paradigm, and we must improve our analysis of what that thing is, as the hidden possibilities behind this

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new frontier may open new horizons for modern physics. Of course, redefining *Ether* in a scientific way is easier said than done, and this makes it even more interesting. The mistake in the past was to think of *Ether* and then the surrounding matter as separate entities; that was the mistake, a fatal flaw in thinking. The new paradigm may help: there is no matter as we know it; there is only continuous *Ether* arranged in many ways.

I fully realize that mentioning the word *Ether* is looking for trouble. As a result, a little discussion seems appropriate. A difficulty encountered by the audacious speculator lies in the limitations of language. Truly new perceptions necessarily lack the words and grammar for their expression. A beautiful example of that today is the use of *Cold Fusion* for what is indeed *Low-Energy Nuclear Reactions*. New words and new grammar must be invented if new ideas are to be successfully communicated to an often reluctant and suspicious audience, which is legitimate to prevent anarchy. Use of old words in a new connotation may lead to trouble. The word *Aether* or *Ether* is such a word, even though it should serve well to describe whatever it is that exists between the "particles" that make up our world, our universe, and is now known as "space," thereby

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removing, or at least complicating any desire to refer to a condition of absolute nothingness.

Other words and phrases, such as “field,” “vacuum of space,” “vacuum structure,” and so on-and-on, have so many meanings that they no longer have any clear meaning at all! Only the rejected *Ether* has meaning, and it has been proven not to exist. It is one of the forbidden “Anomalies” or forbidden words of Science. It has joined “phlogiston,” “God,” “perpetual motion,” and today “Cold Fusion” in the forbidden list. Its appearance in a manuscript marks the place at which the Editor stops reading and reaches for the rejection slip.

Now that most Scientists seem to agree that “space,” or “the vacuum,” and so on has “structure” of some kind, perhaps it is time to reintroduce *Ether*, or, perhaps invent a new, more apt word. How about “the firmament”? It definitely has structure.

In this book I decided to keep the word *Ether*, and, yes, I am aware of the risk, just like mentioning the words “*Cold Fusion*” later on in the book.

## 1.2 THE SECOND GIVEAWAY

The impossibility of accounting for all of light's properties, using a single theory, has been the most embarrassing problem of the scientific philosophy for the last 100 years. In some experiments, light behaves as if it was a particle carrying a certain mass. In some other experiments, light behaves as if it was only a wave, carrying no mass at all.

Right there, it is logical to think that our models are incomplete, and perhaps completely off target, or, at the very least **something is missing** or very naive.

In support of such a severe judgment is this quote from Albert Einstein, "I still work indefatigably at science, but I have become an evil renegade who does not wish physics to be based on probabilities." Without being able to prove our models are wrong, he had that great intuition that we were searching in the wrong direction, looking at what makes the Universe, in a very naïve and primitive way.

Just like Oliver Ingamells, Einstein was a man of great logic and intuition. It is interesting to notice that in the concept of vacuoles suggested in this essay,

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there is no need for mass, as everything is waves travelling on a mysterious support and only waves and nothing else exists.

Mass is nothing else than a man-made illusion giving satisfaction to our senses. Or, if we have to refer to mass, then it would be a good idea to redefine it completely by creating much deeper paradigms. Nobody can force a visionary scientist to rely on his five senses only, just for the sake of obeying some kind of philosophy established centuries ago. So, let's be clear about this, when a cat can be dead and alive at the same time, as suggested a long time ago by Schrödinger, it is time to take a deep breath and ask: where are we going? Would it be wise to go back upstream and seek for the tributary we somehow missed?

### **1.3 THE THIRD GIVEAWAY**

Until this day, after 200 years of deep-thinking physics, nobody can explain why a magnet can move a piece of metal from a distance, even in a pure vacuum. By the way, why would gravity act at a distance in a pure vacuum? This is because we make the assumption that there is nothing in a pure vacuum as we know it. The properties of the magnet would be a lot easier to explain, and

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perhaps gravity as well, if we recognize that matter, molecules, atoms, particles, distance, time, and speed do not exist, at least as we know them.

The oneness of what is, including the infinitely compressed waves making the shell, or the edge, of vacuoles may show a better way to solve this mystery since everything would be necessarily connected; right there, I step way ahead of the concepts we will develop in this essay, but it is necessary to give the reader sufficient expectation, and hopefully it will not be a disappointment. But, first, we must be able to formulate the right question; **this cannot happen without breaking a several-thousand-years old paradigm**; we will come back to this later.

### 1.4 THE FOURTH GIVEAWAY

The relatively easy to calculate Rayleigh-Jeans formula tells us that the energy density  $u(\nu, T)$  can be expressed as follows:

$$u(\nu, T) = \frac{8 \cdot \pi \cdot \nu^2 \cdot k \cdot T}{c^3} \quad [1-1]$$

Where  $\nu$  is frequency and  $T$  is the temperature. Obviously, when  $\nu$  becomes very large, the energy density gets to infinity, contradicting experiments. This contradiction is called the “**ultraviolet catastrophe**”; to this day, it is still an

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embarrassment to scientists. Planck's assumption fixed the problem for low frequencies and explains the domain of what we can see experimentally, and it worked very well.

This is clearly telling us that beyond the "ultraviolet catastrophe" and within the domain of extremely high energy and temperatures (X rays and  $\gamma$  rays generated in the cosmos), something unusual is happening that most certainly deserves far more attention, if we intend to clearly understand our sub-quantic identity; it is not taken into account in the above formula. We cannot afford to put such a mysterious missing link on the shelf and then make assumptions in order to justify such forgiveness and live happily in our visible world.

Maybe we should redefine the "ultraviolet catastrophe" as an "exquisitely subtle reason" to use Oliver Ingamells's own words, and then, and only then, we may all become scientists with sufficient integrity. Good reading on this subject is the work of the French physicist Raoul Charreton<sup>2,3</sup>, which clearly shows that, above  $10^9$  degrees Kelvin, the Stefan-Boltzmann law and the Planck constant may become questionable, though they were most certainly extremely useful for low energy levels, as often observed in our everyday lives.

## 1.5 THE FIFTH GIVEAWAY

The Big Bang! What Big Bang? Because it was an embarrassment to physicists that a dense ball of matter could be created just like that out of nowhere, which is in violation of the law of conservation of mass-energy. Obviously, that matter had to come from somewhere, but I always had a doubt about the Big Bang approach, which is nothing more than a convenient model or, if you prefer, a convenient imagining; in my sampling expertise I learned to be very cautious about convenient models. Some may object to that statement as astronomy seems to converge toward that concept of Big Bang. Yes, at the origin of time, as we know it (14 billion years ago), something on a grand scale indeed happened. The problem is: was it a Big Bang or something else we still don't have a clue as to what it was? I go with the second option, and then totally embrace the far more logical approach of the famous astronomer, Sir Fred Hoyle; his steady-state theory is a much wiser one. In his approach, new particles are constantly created, and fast enough that the mass density of the universe remains constant. It was Fred Hoyle's view that if matter could be created out of nothing one time, then why would it not happen all the time? Basically, what was Fred Hoyle trying to say? Something big is missing and perhaps something else is also very wrong. What is missing is the universal background called *Ether* or whatever we please to call it; I don't like the word

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*Ether*, because it was abused in the 19<sup>th</sup> century to the point that people think of it as an instrument of astrology or witchcraft.

And, what is very wrong is to believe in particles separated from that *Ether*, as there are no such things. However, there are plenty of vacuoles with their ghostly, vibrating shell/edge that we confuse with “matter.” So, the Universe is expanding not because of the Big Bang, but out of necessity for “someone” to have more toys in the “room”...

And, this is intuitive, there is no violation of the law of conservation of mass-energy: *Ether*, which has a mass and energy of its own (i.e., some people call them *dark matter* and *dark energy*), which, when disturbed, transforms to what we see as matter and, ultimately, will reform during what astronomers call the Big Rip. Such Big Rip may actually take place inside black holes. The notion that matter is so important to us indeed has its days counted, as we are nothing but waves.

### **1.6 THE SIXTH GIVEAWAY**

This one is a beauty, but still controversial! Pioneer 10 was launched March 2, 1972, and Pioneer 11 on April 6, 1973. By now, they have passed the limits of

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the solar system, travelling in opposite directions. Based on the laws of motion given by Newton and Einstein, we can calculate where they should be today **with extreme accuracy**. Yet, both are short of their target, and slowing down at the same rate. To this day nobody has found a satisfactory answer to this anomaly. If they continue to slow down at the present rate they will be short of their predicted location by more than two million kilometers in 2050.

Such a discrepancy is an embarrassing mystery to scientists to the point that they think they have to revise their model for gravity. But, if *Ether* is real, and has a certain mass of its own, obviously extremely faint, it is likely to be the culprit that put the brakes on these space probes. In such a case, it should become possible to calculate the mass and energy of *Ether* and learn much more about it.

The bad news is that we thought we would have a rough time travelling to the next star, but now it becomes even more difficult as we would have to generate enough energy to compensate for such slowing, all the way.

This giveaway may have to be challenged one day as scientists are now wondering if the heat from nuclear generators powering these probes may be

responsible for the anomaly; it is not sure yet, but Voyager I, Voyager 2, and New Horizon may clarify this debate very soon.

### **1.7 THE SEVENTH GIVEAWAY**

Much closer to us mortals, something fascinating is happening when we look at thunderstorms through a window, from our safe perspective perhaps. In an article published in the Astronomy magazine (May 2011, page 22), researchers, using the Fermi Gamma-ray Space Telescope, detected the birth of positrons at the very same instant as the birth of electrons in intense thunderstorms in the earth atmosphere. Apparently very high energy gamma rays transform into an electron and positron. This is exactly the argument we have proposed in section 5.5 of this essay; this is one more fascinating coincidence added to the slowly accumulating list of undeniable facts, which are the only ways to explain such simultaneous births out of nothing, precisely because there is no such thing as nothing in what we believe to be empty space.

### **1.8 THE EIGHTH GIVEAWAY**

NASA's Fermi experiment on the International Space Station shows evidence that amount of antimatter is greater than expected. According to the Theory of Vacuoles, such observation would make a lot of sense, though we disagree with

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the actual definition of what antimatter is. However, there is no evidence of dark matter particles: this was a predictable observation since there are no particles in the first place; the only thing there is, is that background stuff we call *Ether*. In other words, we try to find the wrong thing using the wrong tool. According to other recent experiments performed in Gran Sasso, Italy, it would seem that experimenters detected signals that could be generated by dark matter particles; these particles seem to be much lighter than expected. They are probably nothing other than very tiny vacuoles, and we are still, in that case, looking at the wrong thing. If *Ether* is the only thing there is, it is extremely likely we cannot detect what it is by using the ghostly fabrics of tiny holes (i.e., matter we see) within the *Ether* itself; clearly we are going nowhere.

### 1.9 THE NINTH GIVEAWAY

An extremely fragile capillary-size string of fungi mycelium can penetrate hard granite like it was butter. Chemically speaking it does not make sense. Biologically speaking it does not make sense. Obviously, something of paramount importance is missing.

Also, a chicken with absolutely no calcium in its diet, but plenty of tiny mica particles, continues to make eggs with shell and continues to have a healthy

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skeleton. Deprive the chicken of potassium and everything falls apart. If the chicken can make calcium from potassium so effectively, then it must involve a relatively simple process. Obviously, we are missing something of paramount importance.

In chapter 10 we give explanations why Low-Energy Nuclear Reactions may take place among mercury isotopes in CFL lamps. We also suggest explanations about lithium batteries overheating and potentially taking on fire. Explanations are relatively simple leading to the strong belief we are on the right track. There is no coincidence between a mysterious phenomenon and finding a simple explanation, which recurs over and over again through the entire book.

With the Theory of Vacuoles, we suggest that Low-Energy Nuclear Reactions may be far more common in nature than we ever suspected, opening a new field of research with astonishing possibilities.

### **1.10 THE TENTH GIVEAWAY**

We vastly misunderstand neutrinos coming from stars. Not only do they unexpectedly change their behavior and have bizarre personalities of their own, but many of them disappear from our observations and we don't have a clue

where they go. The inescapable conclusion of the last 20 years of research is that our Standard Model of Particle Physics is wrong; or, at least, something of paramount importance is missing, which strongly suggests it is urgent to change the paradigm.

### 1.11 PRELIMINARY CONCLUSION

Why is it that for all these giveaways if the notion of *Ether* is introduced, mysteries seem to vanish? Is it coincidence? I don't think so. Along the way, in this essay, we will encounter other troubling coincidences; it is because of them that I think the way I do today!

### 1.12 MATTER IN THE WAY OF CONSCIOUSNESS

The questions with the answers we all seek: what is this extraordinary mystery about the significance of life? What is the purpose of man? What is the purpose of the beautiful oriole sitting on a branch of silver maple outside the house? What is this incredible and baffling mystery about consciousness? Why me, at this peculiar time, through the billions of years of the Universe?

Exactly like many people did, I came to the conclusion that answers to these questions are impossible... **unless we question the very existence of matter**

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**as we know it.** For thousands of years we learned, by choice and necessity, to define matter with our five senses. I am convinced that our definition of matter is misleading and appropriate to our primitive nature only... after all, it is not too long ago we learned how to walk on two feet!

What would the Universe be without matter? Someone may say “it would be empty and therefore incredibly boring.” But, what if there is indeed something far subtler and magical beyond our finite minds? What if this old notion of “*Ether*” becomes updated to a new, more complete and logical form, and becomes actually the key to everything?

I insist on the word “updated” as the original definition is definitely too naïve to help us in our scientific endeavor. **A more valuable definition of *Ether* is given to us in the general theory of relativity, according to which space without *Ether* is unthinkable.** But, it is my view we made a mistake long ago when we assumed *Ether* was another form of matter consisting of some kind of unknown particles in motion observable through time; as a result, the concept of *Ether* could no longer sustain the criticism of scientists for very long, and they did indeed kill it.

**What if *Ether* was the only thing there is?** What if matter as we know it is only the ghostly image of disturbances within the *Ether*? Somehow, a new idea on how to define matter may lead to all these answers we seek. Then, in such a case, we must have the courage to break a paradigm many thousands of years old, or we will never make progress.

Accessibility to all the answers we seek implies unconditional empathetic understanding and creativity about these boundaries inside which we too often make ourselves prisoner, so we can appreciate their limitations and find better ones. By all means, we should not say there is something wrong with physics; instead, we humbly say there is something of paramount importance that is just missing and it is crying very loudly for us to finally “see” it... or, I should say, imagine it. The reason I make this little distinction is because, all along in our attempts to understand the Universe in which we live, there is that eternal, visceral necessity to base all our interpretations on experiences we can see and, relate to every day. In other words, there is always this duality between a visual interpretation and a mathematical one. The word *Ether* is obviously very naïve, but ordinary people may relate to it, while *space-time* is far more abstract and only accessible by few people. This is playing with words, but what counts

is that, at the end of this book, we will have opened new doors beyond which we must explore.

### **1.13 BREAKING A PARADIGM**

What is a paradigm? Paradigms are those thoughts we take for granted and limit us. The problem with this is that it may take a long time to realize that those thoughts do not necessarily reflect what the truth really is. Therefore, sometimes it is necessary, to some extent, to have the courage to unlearn what we know, or we will never grow. Then, you may ask, what are the new paradigms? There are at least seven of them; along our journey in this essay we will find many more.

1. There are no photons, as we know them.
2. There are no particles, as we know them.
3. There are no atoms, as we know them.
4. There are no molecules, as we know them.
5. There is no matter in the Universe, as we know it.
6. Mass, distance, time, and speed are concepts created by humans to explain what we learn from our senses; they do not exist as such.
7. We don't have a clue about who we really are ...

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At this point, I know any well-trained scientist would be ready to close the book, and ask for his money back, especially if he or she is a chemist by trade, just as I am. However, it is a fact that, philosophically and scientifically speaking, the evidence is overwhelming, well-founded, and appalling; but, our minds have not been wired to see such fact; they were wired to find food for the survival of our loved ones, and along the way we completely lost focus on who we really are by creating models and beliefs that are compatible only with the mind of a quite advanced monkey.

Then, what can replace these old beliefs? I give you the conclusion and, of course, we will have to substantiate it throughout the essay; the following paragraphs are from my friend Oliver Ingamells.

During the 1930's, I followed the fascinating ways of Physics with enthusiasm (while working on a BAsC, pre-med), and lapped every morsel with faith. I strove to put my own ideas into the pot, sometimes with "success." Then Schroedinger, Dirac, and Louis de Broglie came. The Bohr atom satisfied me, **except that its centrifugal force opposing the attraction of electron and proton must surely be something else.** I decided that Schroedinger et al. had glanced at the others and perceived them to be inadequately equipped mentally to handle

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the situation; they had a cat-in-a-box game thrown to them and a couple of wave equations and told them to go play in the sand box, **where they still play today.**

At New York Mensa meeting, I discovered Martin Ruderfer<sup>4,5,6</sup>, and found his ideas far ahead of mine, but along the same general thought line. He, like me, explored the off-beat literature for ideas. W.M. Honig mounted the journal "Speculations in Science and Technology" and gave me my first "legitimate" paper on my ideas<sup>7</sup>. Previous publications in J. Basra exist, forgotten somewhere in the British Museum. The acronym, Basra, has had some variations.

The following speculations are listed in the order they entered my thinking, not in order of their receipt.

"Jacques," a Canadian artist<sup>8</sup>, whom I contacted after reading an article in an early issue of SST. He sent me a painstakingly beautiful view of a proton, and explained that he was more into Art than Science, but had convinced himself of the existence of "heart-fields," of which there are 256 (512) ( $2^8$ ) per proton. A heart-field is a pair of exactly opposite vortices swirling together, making neutral

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pairs, obviously similar to neutrons. “Jacques” has provided a substitute for Bohr’s “H centrifuge.”

W.M. Honig<sup>9</sup> suggested that all of vacuum space is filled with a continuously negatively and positively charged space. “In terms of such continuous fluids, drops, bubbles and toroidal vortices can be made to serve as spatially extended fluid models for free electrons, atomically bound electrons and half one dipole electromagnetic field distributions respectively.” This is, of course, just a lifting from a sophisticated, well-illustrated and knowledgeable work.

T. Gilmore<sup>10</sup> (Geocubic Theory, T. Byron G. Publishing Co., California) draws attention to the fact atoms have about the same radius, almost regardless of mass. This radius is that of the un-excited (Bohr) hydrogen atom,  $a_0 = 5.29... \times 10^{-9}$  centimeter. Gilmore squeezes  $a_0$  spheres into corresponding cubes to make a space structure: a “geocubic matrix” that “flashes” on and off. He has drawn diagrams for most atoms, using ever smaller sized spheres to fill in the cubic spaces. No effort is made to show the individual nature of the spheres. They act as position indicators only. Effort is made to relate atomic characteristics.

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M. Simhony<sup>11-14</sup> introduces “The Electron-Positron lattice space” describing a network of cubes with alternate + and – corners, resembling a sodium chloride cubic crystal structure. The dynamics of this model (Epola) are described, and the text covers many of the several contemporary Physical speculations now considered. Like Honig’s quote above, this is only a lifting from a very useful document, to be dealt with in detail later. The epola cube side measures  $2.82... \times 10^{-13}$  centimeters, the classical radius of the electron, and thus yields a much smaller “mesh” than Gilmore’s geocubic honeycomb.

D.S. Robertson<sup>15</sup> (Speculation on the nature of the atom, Malvern, Worcestershire, England) proposes a “nested honeycomb system” [my interpretation – forgive please!] with cubes of side  $2.27... \times 10^{-14}$  centimeters at the lowest size, through which neutrons move from small to larger cubes. Expansion of this idea begins a treatment of the “drip planes” of the periodic table of elements from the higher to the lower elements, instead of low to high. This is more than another relevant “lifting” and not a statement of Robertson’s theory.

R. Charreton<sup>3</sup> (A sketch of a new theory of atomic particles, translated from the French by J. Crowley) displays a computer program that pretends tracing electron

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paths in atoms. This is to be compared with Honig's ideas on losses of electric energy during reflection of electrons from surfaces.

L. de Broglie<sup>16</sup> introduces the idea of a "subquantum medium." **To me, this represents a first recognition of the fact that we should be examining the 3-D universe from inside it and not as though it was on a table outside ourselves! We are an integral part of our universe, and it is mandatory to be so during our examination of its, our properties.**

Martin Ruderfer was largely responsible for the beginning of this work, and should take credit for that.

These notes from Oliver Ingamells show **a pattern converging toward a way to look at ourselves in a totally different way.** It is, and has been for a long time, my opinion as a person with great interest in very ancient archeology and anthropology, that some people through the ages made some unusual breakthroughs in the ways they meditated. I truly think we have been guilty of thinking these ancient people were primitive and naïve in their ways of thinking. I strongly believe that we have always taken them for being far more stupid than they were, and it is not farfetched to think that a few of them made stunning,

long-forgotten breakthroughs because nobody really understood them or really cared, at the time.

**There are no atoms as we know them. There are no particles as we know them. There is no matter as we know it. The Universe is a “continuous medium” dancing, waving, contracting itself, compressing itself into something resembling “particles” and “atoms,” swirling, and pulsing in infinite ways at our “sub-quantic” level.**

**But, there is a little twist in all this, as some experiments seem to prove; that “continuous medium” seems to be well aware of what it is doing. If we can learn how to look at ourselves that way, we may make stunning progress in a short time, as many scientists around the world are extremely capable, well prepared, and ready to enjoy what they are really made of.**

### **1.14 DARWIN TO THE RESCUE**

What about “creation” and “evolution”? Who is right and who is wrong? At this stage my friends there is nothing such a trivial detail can teach us anymore. We were created indeed, obviously not in the usual naïve way we were taught, and

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at the same time we were meant to evolve. If both sides of this silly debate were opening their tiny little minds a little more, they would find themselves on the same side. So, together, as brothers and sisters, let's enjoy who we are, let's be proud of who we are, let's evolve and let's create at the same time, as this is truly our common mission, the eternal mission of the universal sub-quantum "stuff."

## CHAPTER 2

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### THE HYPOTHESIS OF VACUOLES

The *Ether* is everything, and is activated by an extremely large variety of waves, with different amplitudes (i.e., the maximum departure of the value of an alternating wave from the average value), different periods, and different frequencies (i.e., the number of repetitions of a periodic process during a unit of time).

#### 2.1 THE CONCEPT OF VACUOLES

Because of **local disturbances or other causes** beyond our understanding so far (e.g., vortices, or addition of harmonic oscillators just like soldiers crossing a bridge would do if they were marching in perfect sequence), the *Ether* may compress or perhaps coalesce into a spherical shell, the center of which is absolutely empty, empty in a frightening way.

In this case the definition of “empty” is totally different from what we know. It is not like an empty room, that is actually full of gases, or an empty space between

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the stars, that is actually full of electromagnetic waves travelling on an unknown support: the support is a must, like it or not. The emptiness we are talking about here is far beyond these earthly concepts. It is the “perfect” void where nothing exists and where nothing can go, not even light or any electromagnetic waves. If there was such an empty space between stars we would not be able to see them as nothing would exist to transport their image. In other words, nothing can go through that empty space, not even light.

*Light* is often capitalized in this essay as it represents the only true original medium we are all made of. It was the author’s choice in his historical novels, rather than *Ether*. *Light* has a mystical personality; for us mortals it is an overwhelming property. *Light*, a mysterious medium activated by waves, is the only thing there is and therefore it is a humbling concept. This concept alone has stunning implications, as the Hypothesis of Vacuoles is no longer a bizarre idea, but a necessity to explain many things that are not clear to scientists today; they all, physicists and astronomers, more or less suspected the existence of such a medium, but were all in constant denial. It is rather surprising that that denial is so strong that we prefer to imagine myriad particles we never saw and never will for most of them. All along, we based our research on a paradigm created by what we can touch, smell, hear, taste, and see. We

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must find a way out of the paradigm and the Hypothesis of Vacuoles is a very attractive, subtle way to do this, as it liberates the bored observer who instead **expresses the desire to become a creative participant.**

In this essay we chose to call such a perfect void a “**vacuole.**” It is powerful in itself, as a universal necessity, and frightening in itself as a component whose properties are only known to the Universal Consciousness... regardless of our presence in the Universe or not. For those who are uncomfortable with the concept of Universal Consciousness, we could replace it with Universal Entanglement, which is playing with words.

Our objective is to show that what seems to be a “particle” in our 3-D Universe, which is a thing with mass, spin, color, strangeness, flavor, wavelength, etc. This particle is no more than an observation of a point of intersection with the n-D Universe or, in the case of the “strongly-interacting particles,” simply a 3-D hole or vacuole. Therefore, it should be clearly understood that **the real “vacuole” may be something in its n-dimensional context, far more complex than a naïve little sphere with nothing in the middle, which is a 3-dimensional perception we are familiar with.** We will often refer to that 3-dimensional vision of a vacuole to keep things relatively simple for the reader;

however, the reader, and especially Physicists, should keep their mind open for a much deeper vision of their own, nevertheless based on the same principles.

## **2.2 THE TWO CLASSES OF “PHOTONS”**

According to Charreton<sup>2,3</sup>, there are two classes of photons depending on their “face” or polarization. It is actually a different view of what *Ether* is, but it is an interesting concept.

## **2.3 PROPERTIES OF THE SHELL OF A VACUOLE**

The properties of the shell of a vacuole and how it behaves with its siblings is the key to matter, and this is the connection with the world as we know it. In a naïve way it is the jump from a photon to an electron or to a positron (i.e., positive electron). However, we should not think in terms of the shell and the surrounding *Ether* as suggested in the simplistic sketch illustrated in figure 2-1, but instead of the *Ether* compressing itself into a tiny vacuole surrounded by a shell of extremely high frequency and extremely short-period waves.

Remember that frequency and energy are the same things. As a result, the shell of a vacuole carries enormous energy. It is important to imagine continuity in the nature of the medium between the *Ether* outside the vacuole and the *Ether*

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inside the shell of the vacuole as it is exactly the same thing, as better suggested in figure 2-2 (I wish I could draw this in a better way).

The vacuole, with a certain apparent mass to us now, can freely move within the non-compressed or much smaller frequency longer-period medium, at a certain “speed”; the vacuole is the building block of everything. The vacuole and the electron or positron may have a lot of things in common. The difference is made in our limited mind; but we can ascend in consciousness and make a far subtler difference. It is conceivable that the electron has a vacuole at its center. In other words, there are no particles such as electrons and electromagnetic waves, therefore, they should not be observed as if they were different things. There are only electromagnetic waves, which compress as a shell and, that shell is what we call a particle. But, let’s be very clear about this: there is no discontinuity of any kind between the waves within the shell and the “normal” waves surrounding the shell: this is the real proposition of this essay, and it has mind boggling implications, as there is no longer a particle there and another one somewhere else, instead we have vacuoles possessing the formidable property of absolutely total connectedness (i.e., Universal Entanglement).

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So, the vacuole is indeed the building block of other more complex “particles.” For example, the proton may be an assemblage of vacuoles or may be a subtle form of a positron given specific conditions.

*Analogy for a mortal:* Imagine a square piece of fabric, which is the *Ether*. You use it to filter the skin of cooked cherries to make cherry jelly. For a time, a pocket was created and given a certain mission. The pocket was born. When the mission of filtering is complete, the piece of cloth is washed and the pocket is gone or, we should say, dead. All along the piece of cloth remained the same, and it may go now on another mission, say making the sail of a racing boat.

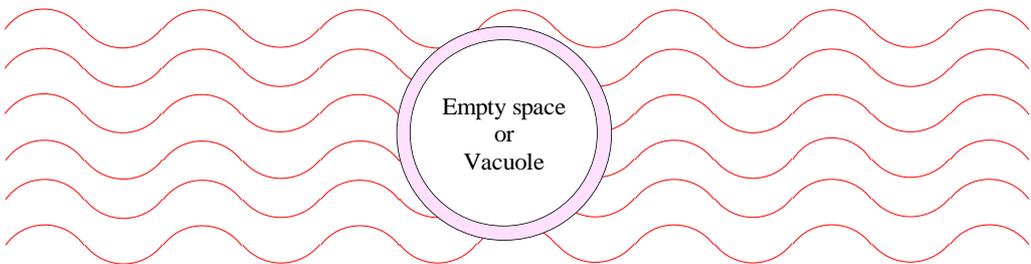


Figure 2-1. A simplistic general, 2-dimensional view of a vacuole

Figure 2-1 shows a discontinuity between the shell of a vacuole and background electromagnetic waves. Therefore, this is a very bad drawing on the author's

part (sorry, nobody is perfect!), as it should show continuity between the background waves and the far more energetic compressed waves within the shell. Figure 2-2 shows a better continuity between the vacuole and the background electromagnetic waves; but, even there the author is not satisfied with that 2-dimensional drawing. At this point, it is clear that a particle is no longer a solid sphere as is often suggested but, instead, a vibrating shell that carries enormous energy and, at its center, **nothing at all**. The nothing at all, where nothing at all can ever travel, is a frightening “nothing” indeed.

## **2.4 SUGGESTED PROPERTIES OF THE VACUOLE**

The n-dimensional Universe is an entity made of negative and positive “stuff,” giving it the overall character of a neutral fluid (e.g., a magnet). This “stuff” is timeless, without beginning and without end, and it apparently knows what it is doing, as strongly suspected by Einstein and many others, and as shown by experiments sending pairs of “photons” in opposite directions. This “stuff” can be called the *Light* or *Universal Consciousness*, or *Ether* or *Universal Entanglement*, or any other name we please: **it is what is**.

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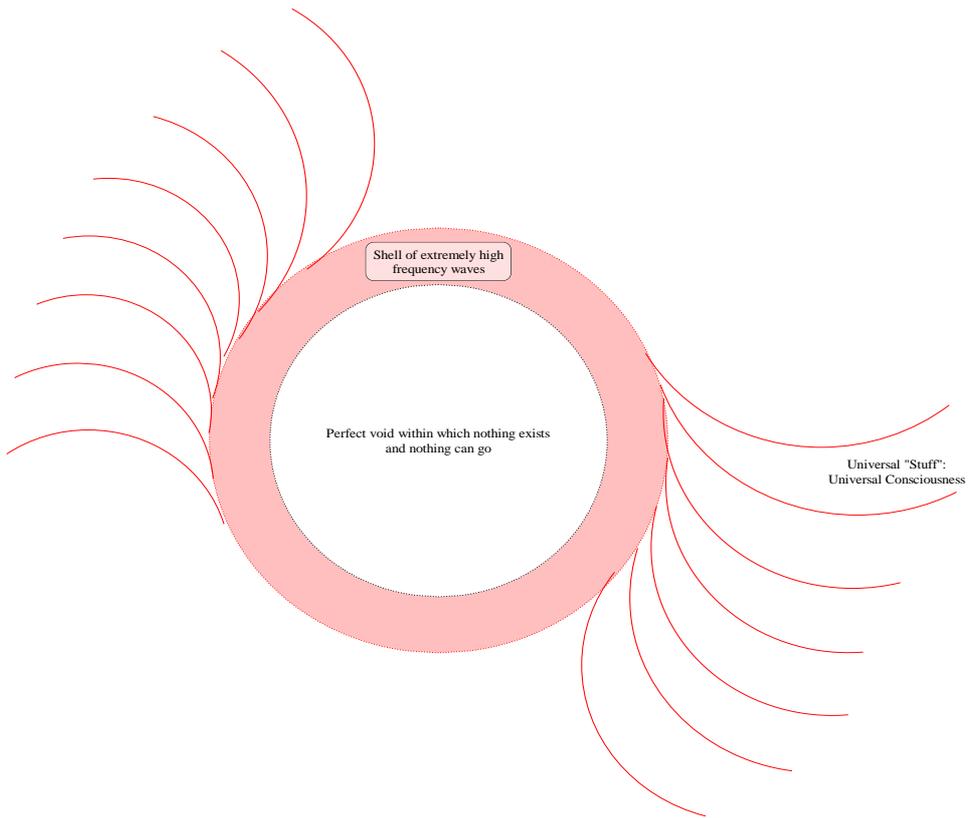


Figure 2-2. A simplistic, magnified, 2-dimensional view of a vacuole flowing freely into what its shell is made of: the universal “stuff” itself, or the *Light*, or the *Ether*.

**What have we tried to say so far? With the vacuole hypothesis it is all waves and only waves and absolutely nothing else but waves activating a certain background medium.**

**So, the claims of quantum mechanics saying that an electron can be at different places at the same time just makes things unnecessarily complicated and, actually, is not quite close to the truth as the particle does not exist in the first place. There are only waves everywhere at once, between vacuoles, and around vacuoles, which may look to us mortals like a shell. Knowing this, it becomes easier to understand the reasons why everything throughout the entire Universe is connected into what we have called in this essay “*Universal Entanglement*,” contrary to local, conditional entanglement suggested by quantum mechanics and its experiments.**

The *Ether* includes a 4-dimensional Universe as part of itself, which exists as a single continuous fluid, and there is absolutely nothing else. “Particles,” as we conceive them, do not exist. Any “structure” of the 4-dimensional Universe is due to “holes,” called vacuoles, which in the continuous fluid, are caused by disturbances, vortices, addition of coincidental harmonic oscillators, or deliberate acts generated by activities on the overall “neutral fluid.”

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A 3-dimensional Universe is set within the 4-dimensional Universe. This is the Universe in which we live, and of which we are a "constituent." However, in that case we are no longer an observer, but an obvious participant: the difference has huge implications and possibilities.

The 2-dimensional Universe is usually a piece of paper on which 2-dimensional projections of 3-dimensional or 4-dimensional Universes are made, often eliminating the necessity for complex figures and constructions. The sketches in figures 2-1 and 2-2, which illustrate a vacuole, are perfect examples and we already see their limitations and naivety, perhaps.

Inside the vacuoles, as already explained, there is absolutely nothing; someone may be tempted to say "it is the perfect black hole." No! Even the color black does not exist within that space; nevertheless, the name "black hole" has a convenient attraction. Vacuoles form an inner surface, or shell, made of the compressed fluid matrix.

The 3-dimensional Universe, of which we are a constituent part, is a 3-dimensional "slice" of the Universe, confined between hyperplanes, which are separated by a distance that we call the **time thickness of our Universe**. In

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subjective terms, **time thickness is the duration of the present instant**. Some people have suggested that there is no past and no future; there is only an eternal present. We may argue this later.

The “particles” that seem to make up the physical world are due to “holes,” called vacuoles, formed in the positive and negative continuum. One dimension of these vacuoles is limited by the distance between the confining hyperplanes of time thickness.

*Analogy for the mortal:* if one spills mercury on a smooth floor, the droplets formed will reach a specific height, whether they are small spheres or larger spheroids.

The time thickness in our “vicinity” has been measured in units of length. It is the Compton wavelength of the electron.

The “strongly-interacting” particles have a vacuole or an assemblage of vacuoles at their core. Other “particles” are disturbances in the continuum related to changes in the shape, volume, distribution, or activity of the vacuoles. It is possible that a vacuole may change shape, for example an electron around

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a proton. The vacuole may, on its orbit around the proton, shape itself as a cylinder, then a complete ring with a perfect vacuum at its core and look like a string. Then, if the vacuole rotates on itself, it becomes obvious that if a mortal observer was looking at two opposite points of the orbit, not only the vacuole seems to be at several places at the same time, but the two points would rotate around themselves in what seems opposite directions, which has interesting new implications.

Vacuole volume is related to mass and temperature. Vacuole surface is related to electric charge.

**Single vacuoles are stable when they have even integral numbers of unit surfaces. Assemblages of vacuoles, or “particles,” are stable when they have even integral numbers of total unit surfaces.**

The time thickness constant,  $t$ , is unique, the same throughout the Universe. The radius of a unit vacuole is not a constant; it is an **arbitrary** selection of a distance, necessary because of the non-definition of universe size and extent.

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It is easy to speculate thus, but not so easy to deduce from the hypothesis a credible explanation of real-world observations and facts. As a first step, we define a spherical vacuole with unit radius  $r$ , unit surface  $S$ , and unit volume  $V$ . All other vacuoles, whether spheres or spheroids, have surfaces and volumes:

$$x \cdot S = 4 \cdot x \cdot \pi \cdot r^2 \quad [2.1]$$

and

$$y \cdot V = \frac{4}{3} \cdot y \cdot \pi \cdot r^3 \quad [2.2]$$

where  $x$  is the number of unit surfaces and  $y$  is the number of unit volumes.

We now need an electromagnetic length, so as to incorporate the constancy of light velocity to the developing scheme. Any accurately known wavelength will do, but complications are least if the Compton wavelength,  $\lambda_c$ , of the electron is chosen. This length is related to the radius,  $r$ , of a unit vacuole by a dimensionless constant,  $t$ , the time-thickness constant,  $\lambda_c = h/(m_e c) = 2tr$ , ( $h$  = Planck's constant,  $m_e$  = electron rest mass,  $c$  = light velocity). Rearranging,

$$h = 2 \cdot t \cdot r \cdot m_e \cdot c \quad [2.3]$$

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A value for the time-thickness constant  $t$  was first estimated by inspection of the periodic table of the elements (Ingamells, 1981 and 1983<sup>18,19</sup>) and found to be close to 2.42... This exercise may be summarized thus: atomic nuclei owe their existence to one or more 3-dimensional vacuoles, with surface  $xS$  and volume  $yV$ . Arrangement of the vacuoles in a nucleus follows rules similar to those governing electron "orbits," (Ingamells, 1967 and 1971<sup>20,21</sup>).

We have reached a critically important point, as it would be extremely unwise to proceed any further, in a logical way, **unless a present paradigm-free system of fundamental dimensions and units is created that would greatly simplify our analysis**. Let's be humble here, I should say, we should create a system of fundamental dimensions and units that may be more in line with the universe we try to explore. This will be a lengthy and tedious development in this essay, but it is necessary. At least, so far, we have slightly opened the window on a concept we intend to explore far more in depth later on.

## **2.5 FURTHER, LATER NOTES FROM OLIVER INGAMELLS**

I made a point to report Oliver Ingamells's words unaltered, so we can all analyze the true underlying principles later on, in a better way.

"I must write this now," he said in 1994, "or I shall never do so. I am being irradiated. Brain is losing function. They say I have about six months to go. Please, my friends, do something! In reading my vacuole hypothesis, I suppose you see the universe with vacuole spread before you.

**You are inspecting it from outside it. That is not the right perspective because you are not outside, you are inside. You are part of it, as is everything in the Universe.**

There are two parts to you: the mind, your tiny share of it, attached to the physical body, a collection of about  $2^{40}$  vacuoles and associated vibrations and structures of astonishing complexity. Physics does not see a real world when it pretends not to be part of it. That is the problem with Physics! Velocity appears

to be “external” to physicists as distance over time. At Daytona, that is a useful approximation, but it is not fundamental!

**Speed of light should not be measured as a velocity; it is a characteristic of the Universe, an area ratio.**

The light-addition equation is best set in hyperbole, indicating a ratio of areas. I have explained this in my latest communication: it matches tradition, as it should, as expected. It is easier to understand, easier to calculate.

Fundamental dimensions of light velocity are:

$$[k \cdot u] = \left[ \frac{\rho}{P} \right] = \left[ \frac{1}{(\text{aratioofareas})} \right] = \left[ \frac{1}{c^2} \right] \quad [2.4]$$

Where  $k$  is the Boltzmann constant,  $u$  is the magnetic permeability,  $\rho$  is a density,  $P$  is pressure and  $c$  is the light velocity which is a ratio of areas.

As better explained in the following chapter, I propose to establish a unit standard vacuole that shall provide "ratioing" for every length, area, and volume

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to be measured within the Universe. It is exactly a sphere, with radius  $r = 1$  new unit of length.

$$r = \text{unitradius} = 1 \cdot NU[L] = 1 \cdot (L)m \quad [2.5]$$

The  $L$  in parentheses converts  $NU[L]$  to meters.

This radius  $r$  is arbitrarily defined as a local constant. It replaces King Henry's Thumb and earth circumference as standard.  $(L)$  is estimated locally at  $5.00614635 \cdot 10^{-9} \text{ m}/NU[L]$  (from Rydberg constant). About  $10^{29}$  (Na) unit vacuoles can exist in one  $\text{m}^3$ , each separated by an average distance of about  $100 r$ .

In any specific circumstance, a value for  $r$  should be established. I believe this device may greatly diminish difficulties in relativistic calculations.

I now ask a question. Who or what installed, wired, powered, and made operative  $2^{29}$  or so vacuoles of which you are physically made? Whence the design of the thousands of tiny Maxwell's demons that pass two drops of water upwards for every downwards drop so that a Sequoia can draw hundreds of tons of water from almost dry soil 75 meters to the topmost canopy?

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A Big Bang? A monkey with a typewriter? Survival of species? Evolution by trial and error? Mutation over millions of years? Pure chance? **I don't buy it!"**

I should emphasize that, to many of his friends when he was alive, Oliver Ingamells seemed very much like an atheist. Just like the French philosopher René Descartes, a well-known so-called atheist in the 17<sup>th</sup> century, the appellation most certainly fits our perceptions better, but most certainly does not fit who the person really was. Many people are called atheists because they believe in a very different way than the common mortal: it is their sacred privilege to be very different, and they are not atheists.

## CHAPTER 3

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### A SIMPLER SYSTEM OF DIMENSIONS AND UNITS

This chapter is of paramount importance. We demonstrate that present systems, **SI or not**, are not appropriate for dimensions and units; accordingly, they are cumbersome and unnecessarily complicated. I could have made an effort to compare our proposition to the metric system alone. I may deviate from that logical approach to preserve Oliver Ingamells's way of thinking, making it very clear, at the end of the day, that it does not make any difference, as the metric system itself, or International Standard, is no more than a polished version of what was inadequate in the first place.

#### 3.1 CONSEQUENCES OF THE VACUOLE HYPOTHESIS

The basic speculation to the vacuole hypothesis (i.e., that matter is made up of holes in the *Ether*) was conceived during the 1940's, at a time when the concept of *Ether* was given its final and absolute rejection. The Standard Model of the day was in a state of flux as relativity, the mass-energy equivalence, and the bomb appeared. *Ether* was buried forever!

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Forever? Maybe not, since something is definitely missing. It now reemerges under a convenient new name – THE VACUUM! The vacuum, with pseudo-particles and zero-point energy and structure, is now necessary to explain a disturbing proliferation of “particles.”

Directly from the vacuole hypothesis, a unitary system has developed that is almost completely freed from arbitrary measures of length, mass, and time, a dimensional system that unites Dynamic, Electromagnetic, and Thermal quantities, and a resolution of the “problem of mass” rightly mentioned by Louis de Broglie; for example, a proton particle is **1836** times heavier than an electron particle or a positron particle. This is a 3-dimensional universe illusion. Also, particles as we know them don’t exist. The Theory of Vacuoles clearly demonstrates that in a 4-dimensional or n-dimensional Universe proton vacuoles and positron vacuoles are exactly the same thing. It all depends on how and where you look at them. This, by itself, should be very intriguing for the reader.

The value of the dimensionless time-thickness constant  $t$  has been established to 13 significant figures. The other dimensional constants, such as the electron

$g$ -factor and the fine-structure constants, are both related to the new constant,  $t$ . Quantity of electricity, such as the electronic charge, is calculated directly from length, mass, and time. The gas constant  $R$  can be unambiguously calculated. Selection of an element, such as the carbon-12, for the establishment of an atomic mass scale has been found unnecessary and cumbersome. Avogadro's number is finally freed from resulting arbitrariness.

### 3.2 UNITS – A HISTORY

On December 10, 1799, the French Legislative Assembly voted to define a standard of length, the “metre” (i.e., meter), as the E-7 part of the earth's quadrant. For those who may not know, Napoleon Bonaparte was in charge, and you did not argue with the First Consul; a short time later he promoted himself to the title of Emperor. On the same day, the mass of a cubic decimeter of water, at its maximum density, was chosen as the standard of mass and was named the kilogram. The third fundamental unit, time, was determined by astronomers as  $1/86400$  of a solar day. Thermal and electrical units are both vaguely related to this  $MLT$  system. The National Bureau of Standards defined the calorie as 4.184 joules. One joule is E7 cgs units of energy. The electrostatic unit of quantity of electricity is the quantity, which, when concentrated at a point 1 centimeter from an equal and similarly concentrated quantity, is repelled by a

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force of 1 dyne. The quantity transferred by one ampere in one second is a coulomb. The *MKS/Giorgi* system of units consists of the meter, kilogram, second, and ohm. The ohm is the resistance of a column of mercury of uniform cross-section having a length of 106.380 centimeters, a mass of 14.4521 grams, and a temperature of 0° centigrade. A centigrade degree is 1/100 of the temperature rise of water on being heated from its freezing to its boiling point under a pressure of one atmosphere, i.e. the pressure exerted by 760 millimeters of mercury at the earth's surface. The ohm is also defined as the electrical resistance between two points on a conductor when a constant potential difference of one volt is applied between these two points, and produces a current of one ampere. An ampere is 1.0363 E-5 faraday/second or 2.9979 electrostatic cgs units. And so on and on; this is what we do science with!

The plethora of units and their definitions and the inconsistencies therein has led to innumerable congresses, bureaus, publications, and passionate discussions, which have led to the *SI* system today; which, as we will see is far from being the panacea. Long ago, Eddington<sup>22,23</sup> proposed that the number of physical constants may eventually be reduced from five or more to only one, "I believe that the whole system of fundamental hypotheses can be replaced with

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epistemological principles... all the fundamental laws and constants of Physics can be deduced unambiguously from *a priori* considerations, and are therefore subjective.” The Vacuole Hypothesis seems to bring this proposal to life.

Currently accepted definitions of the various “fundamentals” appear in the International System of Units (*S*) as follows: The meter is the length of the path travelled by light in vacuum during a time interval of  $1/299,792,458$  of a second. The kilogram is the mass of the International prototype of the kilogram. The second is the duration of 9,192,631,770 periods of the radiation corresponding to the transition between the two hyperfine levels of the cesium133 atom’s ground state. The ampere is that constant current which, if maintained in two straight parallel conductors, would produce a force equal to  $2 \cdot 10^{-7}$  Newton per meter of length between these conductors. The Kelvin, a unit of thermodynamic temperature, is the fraction  $1/273.16$  of the thermodynamic temperature of the triple point of water. The mole is the amount of substance of a system that contains as many elementary entities as there are atoms in 0.012 kilogram of carbon 12. It is very hard to resist noting the “King-Henry’s Thumb” principle here, over which we have not made much improvement, really!

### 3.3 A FEW BASIC PRECAUTIONS

Measuring a physical quantity is to compare it with another physical quantity of the same kind, usually accepted as the unit. Therefore, we could arbitrarily select one unit for each physical quantity and the set of all units would generate a system of units. But, because these units would not have anything in common, the unit system would be incoherent. In this chapter, we have been very careful not to fall into that trap. So, when we change units, it is convenient to use the symbolic formulas that we call **equations of dimensions**, just as we did.

For example let's consider the formula  $v = \frac{\ell}{t}$  that allows the calculation of the speed,  $v$ , of an object moving on a uniform linear trajectory as a function of the space,  $\ell$ , covered during the time,  $t$ . This formula gives a numerical relation between the three numbers  $v$ ,  $\ell$ , and  $t$ , which measure, in a given experience, a certain velocity  $V_1$ , a certain length  $L_1$ , and a certain time  $T_1$ . If, for any reason, we change the units used to measure the same physical quantities, we would obtain three new numbers  $v'$ ,  $\ell'$ , and  $t'$ , but if the conventions defining the unit of velocity generated by the units of length and time are carefully preserved, we would obtain the new formula  $v' = \frac{\ell'}{t'}$ .

All this seems very obvious; however, in my opinion, we should be careful about what we say in this essay, so we don't get carried away.

Now, by dividing the number by its respective sibling we obtain:

$$\frac{v}{v'} = \frac{\ell}{\ell'} \cdot \frac{t'}{t} \quad [3.1]$$

The ratio  $\frac{v}{v'}$  of the numbers that measure a same physical quantity  $V_1$  with

different units  $[V]$  and  $[V']$  is equal to the inverted ratio of the units:

$$\frac{v}{v'} = \frac{[V']}{[V]} \quad [3.2]$$

In the same way, if  $[L]$  and  $[L']$  are the two units of length that are used and  $[T]$  and  $[T']$  the two units of time we would have:

$$\frac{\ell}{\ell'} = \frac{[L']}{[L]} \quad \text{and} \quad \frac{t'}{t} = \frac{[T]}{[T']} \quad [3.3]$$

Then, relation [3.2] gives, between units, the following relation:

$$\frac{[V']}{[V]} = \frac{[L']}{[L]} \cdot \frac{[T]}{[T']} \quad [3.4]$$

Now, let's write:

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$$\frac{[V']}{[V]} = V \qquad \frac{[L']}{[L]} = L \qquad \frac{[T']}{[T]} = T \qquad [3.5]$$

Relation [3.4] would be written:

$$V = \frac{L}{T} \qquad [3.6]$$

Relation [3.6] is called the equation for the dimensions of velocity. It is a relationship between quantities  $V$ ,  $L$ , and  $T$  that represent ratios of two quantities of the same kind, in other words numbers.

It would seem that to obtain the equation of dimensions of a physical quantity we should repeat a similar development each time. However, in general, the overall equation of dimensions of a derived unit is the same as the relation between the numerical values used for the definition of this unit. For example,

for a velocity, the equation of dimensions is  $V = \frac{L}{T}$  and the formula used for the

calculation of the velocity is  $v = \frac{\ell}{t}$ . Then, if the formula allowing the calculation

the measurement  $x$  of a physical quantity  $X_1$  is  $x = a^{\alpha} \cdot b^{\beta} \cdot c^{\gamma}$  the equation of

the physical quantity  $X_1$  is  $X = A^{\alpha} \cdot B^{\beta} \cdot C^{\gamma}$ .

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This means that if  $[X]$ ,  $[A]$ ,  $[B]$ , and  $[C]$  are physical units of a primary system,  $[X']$ ,  $[A']$ ,  $[B']$ , and  $[C']$  are the physical units of a secondary system having the same conventions to define the derived units, we would have:

$$\frac{[X']}{[X]} = \left(\frac{[A']}{[A]}\right)^\alpha \cdot \left(\frac{[B']}{[B]}\right)^\beta \cdot \left(\frac{[C']}{[C]}\right)^\gamma \quad [3.7]$$

Very often, in equations of dimensions,  $A_1$ ,  $B_1$ , and  $T_1$  are fundamental physical quantities of length, mass, and time, however, it is not a must; we could consider the equation of dimensions of a physical quantity relative to other physical quantities, and this is what we did in this chapter.

The equation of dimensions is a relationship between ratios of units, **and has absolutely no other significance. The equation of dimension cannot give us any information about the real dimensions and cannot bring any information about the nature of a physical quantity.** Indeed, for a given unit, the general aspect of the equation of dimensions depends on the conventions that have been chosen for the defined formulas.

However, and this is where Oliver Ingamells makes a huge difference, when the “**seven dimensionally independent quantities**” that are measured with their respective units are recognized as no longer independent quantities, then we better speak up, and at that stage, we may obtain interesting information about the real nature of a physical quantity, as our original understanding was flawed or, at least, inappropriate.

### 3.4 AN ATTEMPT FOR A SIMPLER SYSTEM OF UNITS

As mortals, we live by the clock, with life flowing through us as length  $[L]$ , mass  $[M]$ , and time  $[T]$ . The commonly accepted dimensions of physical quantities are  $[L]$ ,  $[M]$ , and  $[T]$ . Most ordinary things and phenomena are described in terms of these dimensions; it is our paradigm today and it is extremely difficult to think any other way; **it is the way we were told to think.**

If you spill mercury on a smooth floor, the liquid metal will bead into droplets of various sizes. The same happens if water is spilled on a well-waxed car roof. The small droplets are very nearly spheres. The large droplets are flattened or nearly ellipsoidal. The larger ones are flat puddles of uniform height or thickness. Using the “method of dimensions” we may calculate the depth,

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height, or thickness of these drops from three known parameters. The height,  $h$ , depends on  $\rho$ , the density of the liquid, its surface tension,  $\gamma$ , and  $g$ , the force (acceleration) due to gravity, which flattens the droplets of water or mercury. The height of the puddles is a function of these three parameters. Writing this sentence in abbreviated form gives  $h = f(\rho, \gamma, g)$ . We can state the dimensions of density, surface tension, and the acceleration due to gravity on the earth's surface in terms of length, mass, and time. Density,  $\rho$ , is mass per unit volume. Volume is length times length times length, or  $[V] = [L \cdot L \cdot L] = [L^3]$ . If a brick is 0.05 m by 0.08 m by 0.20 m, its volume is  $0.05 \times 0.08 \times 0.20 = 0.0008 \text{ m}^3$ . If the brick weighs 2 kg on this earth (it would weigh much less on the moon), its mass is 2 kg and its density is 2 kg per  $0.0008 \text{ m}^3$ , or  $\rho = 2 / 0.0008 = 2500 \text{ kg per m}^3$ . This is one of the silly systems by which we live and it would not be a very good idea for anyone to challenge it.

Surface tension,  $\gamma$ , has dimensions  $\left[ \frac{M}{T^2} \right]$ , and the force of gravity due to acceleration,  $g$ , with dimensions  $\left[ \frac{L}{T^2} \right]$ . These statements require explanations.

Acceleration is easiest to describe because everyone knows what it is! It is the

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rate of speed increase when you step on the car's gas pedal. In a car, you may measure it in km per hour per second. In one second, you may go from 50 km/h to 60 km/h. Your acceleration,  $a$ , is 10 km per hour per second, with dimensions

km (length) per hour (time) per second (time):  $\text{acceleration} = \left[ \frac{L}{T^2} \right]$ .

Acceleration due to gravity,  $g$ , is the acceleration of an object that free-falls from a height to the earth. It determines the downward force,  $F$ , that any standing object exerts on its floor.

If we put our 0.05·0.08·0.20 m<sup>3</sup> brick on a scale, the scale registers 2 kg. The brick exerts a 2-kg force on the scale. If we were on the moon with the same brick and the same scale, the brick would weigh much less than 2 kg, **but it still has the same mass!**

If  $W$  is the weight of an object,  $M$  the mass of this object, and  $g$  the acceleration due to gravity of the object in free fall, we have the relationship:

$$W = M \cdot g \quad [3.8]$$

Therefore, if  $g$ , at the surface of the earth, has a reference value of 1, then the weight and the mass appear to be the same thing; **they most certainly are not.**

If there are any high-powered physicists or mathematician readers who have managed to stay with me to this point, they will regard the **bolding** I have used above as trivial and unnecessary. This paragraph is just an aside designed to retain the attention of said mathematicians and physicists. Too often, deeply set axioms and beliefs, in exquisitely subtle ways, foiled attempts at the expansion of human understanding. Drawing attention to the “exquisitely subtle” reason for the **bolding** is my real and underlying purpose in constructing this essay.

So, back to the thickness or height,  $h$ , of fluid drops: if we hold our 2-kg brick above the floor, it exerts a downward force on the hand that holds it. This force is its weight, 2 kg of force. While we hold it, its downward speed, with respect to the earth, is zero. If we drop it, its downward speed increases from zero until it hits the floor. It accelerates as it drops. The acceleration,  $g$ , is the acceleration due to gravitational attraction of the earth or, better, the mutual attraction of brick and earth: the earth, being much bigger, does not fall very far toward the brick! If

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bricks don't inspire you, use Newton's apple! It falls with the same acceleration as a brick.

The downward force  $F$ , on the brick is the product of its mass  $M$ , and the acceleration  $g$ , due to gravitational attraction.  $F = M \cdot g = W$  is the weight of the brick on earth. Similarly, the downward force on a puddle of water or mercury is the weight of the puddle, or its mass  $M$ , times the acceleration  $g$ , due to gravitational attraction between the puddle and earth. Stay with me everybody, and enlightenment shall be yours! Ye students! I know why this stuff is difficult for you! It is because the clear unclouded mind instinctively objects to false axioms and to complexities that obscure truth! We now have established that the dimensions of force  $F$ , are:

$$[mass] \cdot [acceleration] = [F] = \left[ \frac{M \cdot L}{T^2} \right] \quad [3.9]$$

Acceleration  $g$  has dimensions  $\left[ \frac{L}{T^2} \right]$ ; distance (km) per hour per second.

Understandable! Surface tension  $\gamma$  has dimensions  $\left[ \frac{M}{T^2} \right]$ . Understandable?

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Not very! Mass per hour per second? SHEESH! (Pay attention everybody! We are getting closer to the “Exquisitely Subtle Reason”).

Surface tension  $\gamma$  is best described as the energy that keeps the droplet of mercury or water from collapsing, which is accomplished by forming a sort of “skin” on the surface of the droplet, or puddle. It is “**energy per unit surface.**” We shall, therefore, have to investigate the dimensions of energy. Energy, as everyone who works for a living knows, is the ability to do work! It is the energy to do something. Our 2-kg brick, held in hand, has energy! If you drop it on your toe it will do work! The energy  $E$  of the brick in hand, available for doing work on your toe, is the product of its weight (the force  $F$  it exerts on your hand) and the distance  $d$  it falls before it hits your toe. The dimensions of energy are force, time, and distance.

We have found that force  $F$  is mass  $M$  times acceleration and acceleration  $g$  is distance per time per time. Thus, the dimensions of energy are:

$$[E] = [F \cdot d] = [M \cdot g \cdot d] = \left[ M \cdot \frac{L}{T^2} \cdot L \right] = \left[ \frac{M \cdot L^2}{T^2} \right] \quad [3.9]$$

In passing, we may remark that the dimensions of velocity,  $v$ , are  $\left[\frac{L}{T}\right]$ ,

distance per unit time. Thus

$$[E] = [M \cdot v^2] \quad [3.10]$$

**This fits nicely with Einstein's deduction that  $E = M \cdot c^2$ , therefore we must be on the right track.**

We may now discover the dimensions of surface tension,  $\gamma$ :

$$[\gamma] = \left[\frac{\text{energy}}{\text{area}}\right] = \left[\frac{E}{L^2}\right] = \left[\frac{M \cdot v^2}{L^2}\right] = \left[\frac{\frac{M \cdot L^2}{T^2}}{L^2}\right] = \left[\frac{M}{T^2}\right] \quad [3.11]$$

Finally, we can find the height,  $h$ , of the drops and puddles. What sort of function shall this be? Shall it be an exponential function?

$$h = f(\rho, \gamma, g) = c \cdot d^x \cdot \gamma^y \cdot g^z \quad [3.12]$$

where  $c$  is a number to be determined. Dimensionally,

$$[L] = \left[\frac{M}{L^3}\right]^x \cdot \left[\frac{M}{T^2}\right]^y \cdot \left[\frac{L}{T^2}\right]^z = [M^0 \cdot L^1 \cdot T^0] \quad [3.13]$$

Since we are after  $[L]$  it has an exponent of 1 and  $[M]$  and  $[T]$  have exponents of zero.

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Dimensions on both sides of the equal sign must be the same, so

$$x + y = 0$$

$$-3x + z = 1$$

$$-2y - 2z = 0$$

then

$$x = -y$$

$$3x = z - 1$$

$$z = -y$$

then

$$x = z$$

$$3x = x - 1$$

$$z = x$$

$$\text{then } x = -\frac{1}{2} \quad y = \frac{1}{2} \quad z = -\frac{1}{2}$$

and

$$h = c \cdot \rho^{-1/2} \cdot \gamma^{1/2} \cdot g^{-1/2} \quad [3.14]$$

or

$$h = c \sqrt{\frac{\gamma}{\rho \cdot g}} \quad [3.15]$$

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Let us now find out if this formula actually works!

Look up the values for  $\rho$ ,  $\gamma$ , and  $g$  in a handbook and you will find the characteristics shown in table 3.1:

**Table 3.1.** Density and surface tension for mercury and water

Physical Quantity	Mercury	Water	Units
Density, $\rho$	13500	1000	$\text{kg/m}^3$
Surface Tension, $\gamma$ (25°C)	0.48548	0.07423	N/m (N/m)= $\text{kg}\cdot\text{s}^{-2}$

We also find acceleration due to gravity,  $g = 9.80$  m per second per second.

Since the numbers we looked up are all in the meters, kilogram, and second system ( $L$  in m,  $M$  in kilograms,  $T$  in seconds), the answers we calculate will appear in meters.

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$$\text{For mercury, } h = c \sqrt{\frac{0.48548}{(13500)(9.80)}} = 0.00192c$$

$$\text{For water, } h = c \sqrt{\frac{0.07423}{(1000)(9.80)}} = 0.00275c$$

We did not determine the dimensionless constant  $c$ , but if you watch the water beads on your newly waxed car, I feel sure you can decide that  $c$  is very close to 1. In other dimensional exercises, even very complicated ones, we find that *Nature* likes her constants to be simple, like 1, 2,  $\pi$ ,  $3\pi/4$ , etc.

It often happens that a messy dimensionless constant, like, for example, the fine-structure constant  $\alpha = 0.00729734$  in an old system..., turns out to be due to some defect in human reasoning or some unobserved mathematical glitch. Everyone knows why  $\pi$ , the ratio of circumference to diameter of a circle in “flat” space, is a transcendental number, but nobody knows why  $\alpha = 0.00729734$ , interestingly in the *SI* system

$$\alpha = \frac{e^2}{4\pi\epsilon_0\hbar c} = 1$$

Thank you, my students, for your attention! I trust you know a little more than you did about dimensions! Perhaps you may wish to stick around while I explain things to Drs. Phys. and Math.

### 3.5 ELIMINATING THE NECESSITY OF TIME AND MASS UNITS

Currently, the International Standard system of dimensions and units (SI) is summarized in the 2011-2012 CRC Handbook of Chemistry and Physics as: The core of the *SI* is the seven base units for the physical quantities length, mass, time, electric current, thermodynamic temperature, amount of substance, and luminous intensity. You may already know this, but I feel its repetition is needed, **because it contains at least one important false implication!** That is, it implies that there is something fundamental about the seven base units. You may reply, “So what? We all know that the meter is a fraction of the earth’s circumference, the second  $1/86400$  of a solar day, the kilogram the weight of a liter of water, etc.”

We now have better ways of measuring the meter, kilogram and second! We also measure mass in electron volts, length in terms of reproducible wavelengths, time using vibrating crystals, and so on.

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Before proceeding, may I repeat the dimensional analysis that discovers the height,  $h$ , of beads of liquid on a smooth surface, using a slightly different approach.

We found the dimensions of density:  $[\rho] = \left[ \frac{M}{L^3} \right]$  [3.16]

This gives mass the dimensions:

$$M = [\rho \cdot L^3] \quad [3.17]$$

We found the dimensions of force:  $[F] = \left[ \frac{M \cdot L}{T^2} \right]$  [3.18]

Pressure,  $P$ , is force per unit area:

$$[P] = \left[ \frac{\frac{M \cdot L}{T^2}}{L^2} \right] = \left[ \frac{M}{L \cdot T^2} \right] \quad [3.19]$$

If we integrate [3.17] with [3.19]:

$$[P] = \left[ \frac{\rho \cdot L^3}{L \cdot T^2} \right] = \left[ \frac{\rho \cdot L^2}{T^2} \right] \quad [3.20]$$

From this, dimensions of time are given by:

$$[T^2] = \left[ \frac{\rho \cdot L^2}{P} \right] \quad [3.21]$$

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We have now invented a new dimensional system,  $LP\rho$ , replacing the conventional  $LMT$  (i.e., length, mass, time) part of the  $SI$  system, **in which there is no need for separate dimensions for  $[M]$  and  $[T]$ .**

Returning to the problem of the height of beads of liquids:

$$h = f(\rho, \gamma, g) = c \cdot \rho^x \cdot \gamma^y \cdot g^z \quad [3.22]$$

Dimension of density: 
$$\left[ \frac{M}{L^3} \right] = [\rho] \quad [3.23]$$

Dimension of surface tension:

$$\left[ \frac{M}{T^2} \right] = \left[ \frac{\rho \cdot L^3 \cdot P}{\rho \cdot L^2} \right] = [P \cdot L] \quad [3.24]$$

Dimension of acceleration:

$$\left[ \frac{L}{T^2} \right] = \left[ \frac{L \cdot P}{\rho \cdot L^2} \right] = \left[ \frac{P}{\rho \cdot L} \right] \quad [3.25]$$

Dimensionally: 
$$[L]^1 = [\rho]^x \cdot [P \cdot L]^y \cdot \left[ \frac{P}{\rho \cdot L} \right]^z \quad [3.26]$$

For dimensional homogeneity: 
$$x - z = 0, \quad y + z = 0, \quad y - z = 1 \quad [3.27]$$

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As before:  $x = -\frac{1}{2}$ ,  $y = \frac{1}{2}$ ,  $z = -\frac{1}{2}$  [3.28]

and  $h = c \sqrt{\frac{\gamma}{\rho \cdot g}}$  [3.29]

At this point, this only shows the obvious, that the  $LP\rho$  and  $SI$  systems are equally useful in resolving this small problem. **It also shows that there is nothing sacrosanct about length, mass, and time as primary dimensions.**

**The importance of this lesson does not fully appear until the other “dimensionally independent base quantities,” the thermal and, especially, the electromagnetic quantities are taken into consideration.**

The quantities of Physics are of three distinct classes, the dynamic (mass, length, time, density, surface tension, and  $c$ ), the thermal (temperature, heat, and entropy), and the electromagnetic quantities (voltage, field strength, magnetic permeability, and electric permittivity). Attempts to expand the  $SI$  system to describe the thermal and electromagnetic quantities have not been entirely satisfactory without adding other basic units, such as temperature,  $K$ , permeability,  $u$ , and permittivity,  $k$ .

### 3.6 ELECTROMAGNETIC QUANTITIES—ELIMINATING THE NECESSITY OF PERMEABILITY AND PERMITTIVITY UNITS

The electrostatic dimensions of electric charge or quantity of electricity,  $Q$ , in the  $MLT$  system are:

$$[Q] = \frac{L^{1/2} \cdot M^{1/2} \cdot k^{1/2}}{T} \quad [3.30]$$

Or

$$[Q] = \left[ \frac{\sqrt{L \cdot M \cdot k}}{T} \right] \quad [3.31]$$

It is necessary to add electric permittivity,  $k$  to the dimensional statement. Magnetic statement of the dimensions of  $Q$  requires the use of magnetic permeability,  $u$ , instead of  $k$ .

In the magnetic system,  $[Q] = \left[ \sqrt{\frac{L \cdot M}{u}} \right] \quad [3.32]$

It is well established that the product of  $k \cdot u$  is numerically equal to  $\frac{1}{c^2}$ , where

$c$  is the velocity of light, so that:

$$[k \cdot u] = \left[ \frac{1}{c^2} \right] = \left[ \frac{T^2}{L^2} \right] \quad [3.33]$$

In solving the problem of the height of liquid beads, we showed how to convert from a  $MLT$  system to a  $LP\rho$  system. The reason for this exercise may now appear. Changing from the  $MLT$   $k \cdot u$  to the  $LP\rho$  systems enables us to eliminate  $k$  and  $u$  from the dimensional formula for quantity of electricity and all electromagnetic quantities!

**This is huge progress; again, it becomes rather obvious time and mass do not need units on their own as they are relative concepts that depend on other, far more fundamental, factors. It was also an easy way to demonstrate the undeniable relativity of time and mass.**

Conversion of time,  $T$ , to the  $LP\rho$  system gives  $[T^2] = \left[ \frac{L^2 \cdot \rho}{P} \right]$ , therefore:

$$\left[ \frac{1}{c^2} \right] = \left[ \frac{T^2}{L^2} \right] = \left[ \frac{L^2 \cdot \rho}{P \cdot L^2} \right] = [k \cdot u] = \left[ \frac{\rho}{P} \right] \quad [3.34]$$

A note on the value of  $k \cdot u$  is in order. Long before the relation  $k \cdot u = \frac{1}{c^2}$  was established theoretically, it was observed to be true to the limits of

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measurements of the three quantities. It is also true that one may assign any

dimension and any value to either  $k$  or  $u$ , provided the relation  $k \cdot u = \frac{1}{c^2}$  is

numerically and dimensionally satisfied. There should, therefore, be no objection

not only to  $[k \cdot u] = \left[ \frac{T^2}{L^2} \right] = \left[ \frac{\rho}{P} \right]$ , but also to  $[k] = \left[ \frac{1}{P} \right]$  and  $[u] = [\rho]$ .

We may now convert electromagnetic quantities from  $LMTk \cdot u$  to  $LPD$  using:

$$[M] = [\rho \cdot L^3], \quad [T^2] = \left[ \frac{\rho \cdot L^2}{P} \right], \quad [k] = \left[ \frac{1}{P} \right], \quad [u] = [\rho]$$

Then, the quantity of electricity,  $Q$  is:

$$[Q] = \left[ \frac{L^{\frac{3}{2}} \cdot M^{\frac{1}{2}} \cdot k^{\frac{1}{2}}}{T} \right] = \left[ L^{\frac{3}{2}} \cdot \rho^{\frac{1}{2}} \cdot L^{\frac{3}{2}} \cdot P^{\frac{-1}{2}} \cdot \rho^{\frac{-1}{2}} \cdot L^{-1} \cdot P^{\frac{1}{2}} \right] = [L^2]$$

[3.35]

or,

$$[Q] = \left[ L^{\frac{1}{2}} \cdot M^{\frac{1}{2}} \cdot u^{\frac{-1}{2}} \right] = \left[ L^{\frac{1}{2}} \cdot \rho^{\frac{1}{2}} \cdot L^{\frac{3}{2}} \cdot \rho^{\frac{-1}{2}} \right] = [L^2]$$

[3.36]

The Potential Difference,  $E$  is:

$$[E] = \left[ \frac{L^{\frac{1}{2}} \cdot M^{\frac{1}{2}}}{\sqrt{T \cdot k}} \right] = \left[ L^{\frac{1}{2}} \cdot \rho^{\frac{1}{2}} \cdot L^{\frac{3}{2}} \cdot P^{\frac{1}{2}} \cdot \rho^{-\frac{1}{2}} \cdot L^{-1} \cdot P^{\frac{1}{2}} \right] = [P \cdot L] \quad \text{or,} \quad [3.37]$$

$$[E] = \left[ L^{\frac{3}{2}} \cdot M^{\frac{1}{2}} \cdot T^{-2} \cdot u^{\frac{1}{2}} \right] = \left[ L^{\frac{3}{2}} \cdot \rho^{\frac{1}{2}} \cdot L^{\frac{3}{2}} \cdot P \cdot \rho^{-1} \cdot L^{-2} \cdot \rho^{\frac{1}{2}} \right] = [P \cdot L] \quad [3.38]$$

The product  $Q \cdot E$  should, of course, have the dimensions of energy:

$$[Q \cdot E] = [P \cdot L^3] = [L^{-1} \cdot M \cdot T^{-2} \cdot L^3] = \left[ \frac{M \cdot L^2}{T^2} \right] \quad [3.39]$$

The  $LP\rho$  system may be improved by noting that the dimensions of velocity are:

$$\left[ \frac{L}{T} \right] = \left[ \frac{P^{1/2}}{\rho^{1/2}} \right] \quad [3.40]$$

and introducing a dimensional quantity,  $C$ , to replace, for convenience only, the otherwise clumsy  $L/T$  expression for velocity. We then have a  $LP\rho C$  system.

Some  $LP\rho C$  dimensions of electromagnetic quantities follow.

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$$\text{Magnetic Field Strength, } H : \quad [H] = [C] \quad [3.41]$$

$$\text{Electric Current, } I : \quad [I] = [L \cdot C] \quad [3.42]$$

$$\text{Electric Resistance, } R : \quad [R] = [\rho \cdot C] \quad [3.43]$$

$$\text{Electric Inductance, } \frac{E \cdot T}{I} : \quad \left[ \frac{E \cdot T}{I} \right] = [\rho \cdot L] = [R \cdot T] \quad [3.44]$$

$$\text{Magnetic Moment:} \quad [L^3 \cdot C \cdot \rho] \quad [3.45]$$

$$\text{Electric Moment:} \quad [Q \cdot L] = [L^3] \quad [3.46]$$

**The  $LP\rho C$  system eliminates fractional exponents in dimensional expressions, provides a clear perception of the meaning of  $k$  and  $u$ , and simplifies dimensional operations in the “electromagnetic” system.**

Solving an electromagnetic dimensional problem using both the  $MLTu k$  and  $LP\rho C$  systems is instructive.

*Problem:* Find the magnetic field strength at distance,  $d$ , from a magnet of length much less than this distance and with a magnetic moment,  $m$ . Table 3.2 shows the needed characteristics.

**Table 3.2.** Comparison between *LMTku* and *LPDC*

Physical quantity	Symbol	Dimensions <i>LMTku</i>	Dimensions <i>LPDC</i>
Magnetic field at <i>p</i>	<i>H</i>	$\left[ \frac{\sqrt{M}}{\sqrt{L \cdot T^2 \cdot u}} \right]$	$[C]$
Magnetic moment of magnet	<i>m</i>	$\frac{\sqrt{L^5 \cdot M \cdot u}}{T}$	$[L^3 \cdot \rho \cdot C]$
Distance from magnet	<i>d</i>	$[L]$	$[L]$
Magnetic permeability	<i>u</i>	$[u]$	$[\rho]$

$$H = f(m, d, u) = c \cdot m^x \cdot d^y \cdot u^z \quad [3.47]$$

In *MLTu* terms,

$$\left[ \frac{\sqrt{M}}{\sqrt{L \cdot T^2 \cdot u}} \right] = \left[ \frac{\sqrt{L^5 \cdot M \cdot u}}{T} \right]^x \cdot [L]^y \cdot [u]^z \quad [3.48]$$

$$\frac{1}{2} = \frac{x}{2}, \quad -\frac{1}{2} = \frac{5x}{2} + y, \quad -1 = -x, \quad -\frac{1}{2} = z + \frac{x}{2} \quad [3.49]$$

In  $LPDC$  terms,

$$[C] = [L^3 \cdot \rho \cdot C]^x \cdot [L]^y \cdot [\rho]^z \quad [3.50]$$

$$1 = x, \quad 0 = 3x + y, \quad 0 = x + z \quad [3.51]$$

$$\text{In either case, } x = 1, \quad y = -3, \quad z = -1 \quad [3.52]$$

$$H = c \left[ \frac{m}{u \cdot d^3} \right] \quad [3.53]$$

The constant  $c$  must be determined otherwise. If  $p$  is on the magnetic axis,  $c = 2$ ; if on the magnet's equatorial plane,  $c = 1$ .

Evidently, the  $LP\rho C$  approach is simpler. More importantly, **it removes the barrier that has existed between dynamic and electromagnetic units**. The reason for this is that the “dimensionally independent base units” of the  $SI$  system **are not dimensionally independent** as falsely claimed. Conversion to the  $LP\rho C$  system demonstrates this. Note that  $LMTu$  yields four equations for only three unknowns.

### 3.7 THERMAL QUANTITIES

**There seems to have been no serious attempt to weld thermal and mechanical dynamics into a single discipline.** In the *MLT* part of the *SI* system, there is no mention of temperature. Thermodynamics makes no mention of time; its reasoning and the equations that express it use Pressure, Volume, and temperature,  $P$ ,  $V$ ,  $T$ . The *SI* system, for obvious reasons, uses the symbol  $K$  for thermodynamic temperature, and this symbol is used here to replace the thermodynamic  $T$ , and also all kinetic symbols that have been used to represent temperature. The thermodynamic volume,  $V$  is rejected in favor of  $L^3$ , or  $[V] = [L^3]$ . As mentioned at the very beginning of this chapter, **the first step toward unification is a common language!** The discovery that  $[k] = \left[ \frac{1}{P} \right]$  and  $[u] = [\rho]$  **has united electromagnetic and dynamic quantities.** There must be a way to include thermodynamics, thermionics, and kinetics in the scheme. **If someone, somewhere, on some enchanted evening long ago, had decided, intuitively or otherwise, that the proper dimensions of electric charge are  $[L^2]$ , Physics today would be very different,** if, of course, he or she had gained attention to this idea, which is a very optimistic assumption.

The above statement from Oliver Ingamells has huge implications and it triggers cautions in my mind, as were clearly addressed in the few basic precautions that I mentioned earlier in this chapter.

Incorporation of thermal quantities in the existing scheme will not be easy. Fundamental adjustments will have to be made; basic opinions and beliefs must be altered, if not completely overturned. In this attempt, we intuitively, or otherwise, guess that the proper dimensions of temperature are

$$[K] = [L^3 \cdot C^2] = \left[ \frac{L^3 \cdot P}{\rho} \right] \text{ in the } LP\rho C \text{ system and, therefore, } \left[ \frac{L^5}{T^2} \right] \text{ in the}$$

*LMT* system.

Before dealing directly with thermal problems, it is necessary to recall the *SI* (2011-2012) definitions of the units in which the “**seven dimensionally independent quantities**” are measured.

**Meter:** the path length travelled by light in a vacuum during 1/299,792,458 of a second.

**Kilogram:** The mass of the International kilogram prototype.

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**Second:** the duration of 9,192,631,770 periods of radiation corresponding to the transition between the two hyperfine levels of the cesium 133 atom's ground state.

**Ampere:** The constant current which, if maintained in two straight parallel conductors of negligible cross-section, and placed 1 meter apart in vacuum, would produce between these conductors a force of  $2(10^{-7})$  newton per meter length.

**Kelvin:** the fraction  $1/273.16$  of the thermodynamic temperature at the triple point of water.

**Mole:** the amount of substance in a system that contains as many elementary entities as there are atoms in 0.012 kilogram of carbon 12.

**Candela:** the luminous intensity, in a given direction, of a source that emits monochromatic radiation at the frequency of  $540(10^{12})$  hertz and that has a radiant intensity in that direction of  $1/683$  watt per steradian.

Symbols for units are m, kg, s, A, K, mol, and cd, respectively.

These rather arcane definitions were designed to correct difficulties with the original definitions of these quantities arising from the ever-increasing precision and accuracy of measurements. This does not remove the "King Henry's Thumb" nature of the original definitions on which those written above are

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based. To unite the dynamic, electromagnetic, and thermodynamic systems will require careful consideration of all these original definitions, which will require revision of some favorite axioms.

**The SI unitary system is based on earth's properties. This may be better than a system based on King Henry's dimensions, but it is arbitrary and hardly more fundamental!**

There is a clear relationship among kilogram, meter, and second, and even a vague relationship among these and temperature. The meter is a fraction of the earth's circumference, the kilogram is the mass (originally the weight) of a cubic decimeter of water and, thus, is related to the kilometer and the earth's mass through the gravitational constant. The second is 1/86,000 of a solar day and, hence, is related to the earth-sun distance in kilometers. The degree Kelvin is 1/100 of the difference in temperature of boiling and freezing water at 0.760 meter of mercury of ambient pressure.

**These units were adequate and appropriate when the earth was the center of the Universe; they are no longer appropriate. Dressing them up by improving their definitions does not help, only sweeping changes will.**

To establish a new unitary system requires selection of more appropriate units for length, mass, time, electric current, temperature, amount of substance, and luminous intensity. On the way, it may be demonstrated that these are not all dimensionally independent, as has been demonstrated for electric charge.

As a first step, we may examine the concept of length or distance, and area, volume and content, with the intent of selecting a new unit. **The idea of using a well-established wavelength is appealing and adds the possibility of finding a new unit of time during the same exercise.**

### 3.8 THE DIMENSIONS OF LENGTH

Length,  $L$ , is a vector quantity. It is necessary to distinguish dimensionally among  $[L_x]$ ,  $[L_y]$ ,  $[L_z]$  and possibly  $[L_t]$ , where  $x$ ,  $y$ ,  $z$  refer to three spatial directions and  $t$  refers to time. Problems in dimensional analysis often require that the vector character of length be taken into account. A simple example may illustrate the concept.

*Problem:* Find the rate of fall of a small sphere through a viscous fluid. In a classic experiment, Millikan made use of Stokes' solution to this problem of measuring an electron's charge. Table 3.3 lists the relevant parameters.

**Table 3.3.** Examples of physical quantities with their dimensions

Physical quantity	Symbol	Dimensions
Velocity of Sphere	$v$	$\left[ \frac{L_z}{T} \right]$
Density of Sphere	$d$	$\left[ \frac{M}{L_x \cdot L_y \cdot L_z} \right]$
Diameter of Sphere	$r$	$\left[ L_x^{1/2} \cdot L_y^{1/2} \right]$
Density of Liquid	$\rho$	$\left[ \frac{M}{L_x \cdot L_y \cdot L_z} \right]$
Viscosity of Liquid	$n$	$\left[ \frac{M}{L_z \cdot T} \right]$
Acceleration of Gravity	$g$	$\left[ \frac{L_z}{T^2} \right]$

and,

$$v = f(d^x, r^y, \rho^z, n^w, g^v) \quad [3.54]$$

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In this case, it is not necessary to substitute  $\rho \cdot L^3$  for  $M$  or  $\frac{L}{C}$  for  $T$ , the result is the same if this is done. The vector lengths are necessary for the solution, which is

$$v = \frac{(a_{\text{constant}}) \cdot [r^2 \cdot g \cdot (d - \rho)]}{n} \quad [3.55]$$

H.E. Huntley<sup>24</sup> gives a full explanation. Vector lengths are often necessary when angles are involved. The dimensions of an angle are not simply  $\left[\frac{L}{L}\right]$ , but may

be  $\left[\frac{L_x}{L_y}\right]$  or, in the case of light velocity, not  $\left[\frac{L}{T}\right]$  or  $\left[\sqrt{\frac{P}{\rho}}\right]$ , but  $\left[\frac{L_x}{L_t}\right]$ .

Candidates for the role of fundamental unit of length are the classic electron radius,  $r_e$ ; the first Bohr radius,  $a_0$ ; the Dirac Compton wavelength,  $\lambda_C$ ; and  $R_\infty$ , the Rydberg constant:

$$r_e = \alpha^2 \cdot a_0 = 2.81794092(38) \cdot 10^{-15} m \quad [3.56]$$

$$a_0 = \frac{\alpha}{4\pi \cdot R_\infty} = 0.52917720859(36) \cdot 10^{-10} m \quad [3.57]$$

$$\lambda_C = \frac{h}{m_e \cdot c} = 2.4263102175(33) \cdot 10^{-12} m \quad [3.58]$$

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$$R_{\infty} = \frac{m_e \cdot c \cdot \alpha^2}{2h} = 10973731.568527(73)m^{-1} \quad [3.59]$$

With

$$\text{fine structure constant: } \alpha = 7.2973525376(50) \cdot 10^{-3} \quad [3.60]$$

$$\text{electron mass: } m_e = 9.10938215(45) \cdot 10^{-31} \text{ kg} \quad [3.61]$$

$$\text{light velocity: } c = 299792458 \text{ (exact) m/s} \quad [3.62]$$

$$\text{Planck's constant: } h = 6.62606896(33) \cdot 10^{-34} \text{ J/s} \quad [3.63]$$

Numbers between parentheses refer to significant figures that are still uncertain.

Since the dimensions of light velocity are  $\left[ \frac{L}{T} \right]$ , the logical unit of velocity is

$1NU \left[ \frac{L}{T} \right]$ , of length is  $1NU[L]$  and of time is  $1NU \left[ \frac{L}{C} \right] = 1NU[T]$ . Choosing

the conversion factors  $(L)$  and  $(T)$  from  $NU$  to  $SI$  or  $cgs$  or another system depends on the choice of factors from the above listed  $SI$  values. The two most precisely known values are those for  $R_{\infty}$  and  $c$ , but until the  $NU$  value for  $R_{\infty}$  is determined, it is best to begin with  $a_0$  and  $c$ . Benefiting from arguments not

presented herein, the best value for the conversion factor ( $L$ ) is  $(2.3^2 \cdot \pi^2 \cdot \alpha^2 \cdot a_0)$ , then:

$$1NU[L] = 1 \cdot (5.006151...10^{-13}) \quad [3.64]$$

$$SI[L] = 5.006148...10^{-13} m \quad [3.65]$$

The conversion factor ( $T$ ) for time follows at once from the velocity of light,  $c = 299,792,458$  m/s.

$$1NU[T] = 1NU\left[\frac{L}{c}\right] = 1 \cdot \left[\frac{L}{c}\right] \quad [3.66]$$

$$SI[L] = 1.669872...10^{-21} s \quad [3.67]$$

In what follows, values for conversion factors are carried to 7 significant figures, because nearly all are valid to that level of precision, with later establishment of individual precision.

### 3.9 THE DIMENSIONS OF MASS

The difference between mass and weight is well-recognized, but the  $SI$  unit of mass is the kilogram, a unit of weight on the earth's surface. There is a relation between volume density and mass.

$$\rho = \left[ \frac{M}{L^3} \right] \quad \text{or} \quad [M] = [\rho \cdot L^3] \quad [3.68]$$

A distinction is necessary between mass as a quantity of matter or gravitational mass,  $M_g$ , and inertial mass,  $M_i$ . Numerous repetitions of Eotvos' classic experiment with various modifications of a double-armed torsion balance have established that, in any unitary system, the values of  $M_i$  and  $M_g$  are identical. Gravitational and inertial mass are different concepts, related by a conversion factor, 1.00000.

Several Eotvos experiments have established this factor to a precision of at least one part in  $10^9$ , and there is almost no doubt that  $\frac{M_i}{M_g} = 1$ . Inertial mass differs from gravitational mass in that it is a vectorial quantity. In the  $LP\rho$  system, mass has dimensions  $[M] = [\rho \cdot L^3] = [\rho \cdot L_x \cdot L_y \cdot L_z]$ . The inertial mass of a projectile travelling in the x direction has dimensions  $[\rho \cdot L_x \cdot L_y \cdot L_z]$ .

**Discussion of the dimensions of length and mass presented above are preliminary to a welding of dynamic, electromagnetic, and thermal quantities into a single unitary and dimensional system.**

The techniques of dimensional analysis have been used to show the validity of several arguments involving electromagnetic and dynamics. We now apply these techniques to thermal quantities.

### 3.10 HEAT AND TEMPERATURE

Historically, heat has been regarded from two points of view; as a calorific quantity and as a dynamic quantity. The unit of heat is the calorie; it is the quantity of heat that is required to raise the temperature of one gram of water from 14.5° to 15.5° centigrade.

Thermodynamics, on the other hand, regards heat as equivalent to energy, with

dimensions  $[H] = \left[ \frac{L^2 \cdot M_i}{T^2} \right]$ . A conversion factor,  $J$ , converts a number of

calories to a number of Joules.

$$[H] = \left[ \frac{L^2 \cdot M_i}{T^2} \right] = [P \cdot L^3] = J \cdot M \cdot K \quad [3.69]$$

The gas equation  $P \cdot V = R \cdot T$  must be rewritten here as  $P \cdot L^3 = R_g \cdot K$ , to avoid confusion. The thermodynamic  $T$  is replaced by  $K$ , and the gas constant

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$R$  is replaced by  $R_g$ . Dynamically,  $[K] = \left[ \frac{L^2}{T^2} \right]$ . It follows that  $[R_g] = [M]$ . If

$K$  has the dimensions of energy,  $R_g$  is defined by the gas-kinetic equation and

$R_g$  is dimensionless. In the  $LP\rho C$  system,  $[P \cdot L^3] = [R_g \cdot K] = [\rho \cdot L^3 \cdot C^2]$ . This

presents the possibility that the proper dimensions for  $K$  are  $[K] = [C^2 \cdot L^3]$ ,

and the proper dimensions of  $R_g$  are those of density.

$$[R_g] = [\rho] \quad [3.70]$$

and

$$[K] = [C^2 \cdot L^3] \quad [3.71]$$

**Problem:** Find an expression for the thermal conductivity of a gas in terms of the properties of its molecules, supposing the direction of heat conduction is parallel to the x-axis of the apparatus. The following seven physical quantities are involved: thermal conductivity,  $k$ ; molecular mass,  $m$ ; number of molecules per unit volume,  $N$ ; mean velocity of molecules,  $v$ ; mean free path,  $l$ ; gas pressure,  $p$ ; and thermal capacity per unit mass,  $C_u$ . Conversion of the *LMTK* dimensions of these *SI* quantities to *LP\rho C* proceeds through the following relationships:

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$$[M_i] = [\rho \cdot L_x^3] \quad (\text{heat transfer parallel to x-axis}) \quad (\text{see notes below})$$

[3.72]

$$[M_g] = [\rho \cdot L_x \cdot L_y \cdot L_z] \quad [3.73]$$

$$[K] = [C^2 \cdot L_x \cdot L_y \cdot L_z] \quad [3.74]$$

$$[L] = [L_x] \quad (\text{see notes below}) \quad [3.75]$$

$$[T^2] = \left[ \frac{\rho \cdot L^2}{P} \right] \quad [3.76]$$

$$[H] = \left[ \frac{L^2 \cdot M_i}{T^2} \right] = [L_x^3 \cdot P] \quad (\text{see notes below}) \quad [3.77]$$

$$[k] = \left[ \frac{L \cdot M_i}{T^3 \cdot K} \right] = [L_x^2 \cdot L_y^{-2} \cdot L_z^{-2} \cdot \rho^{-1/2} \cdot P^{3/2} \cdot C^{-2}] \quad [3.78]$$

$$[m] = [M_g \cdot L^3] = [\rho \cdot L_x \cdot L_y \cdot L_z] \quad [3.79]$$

$$[N] = [L_x^{-1} \cdot L_y^{-1} \cdot L_z^{-1}] \quad [3.80]$$

$$[v] = [L_x \cdot T^{-1}] = [L_x \cdot \rho^{-1/2} \cdot L_x^{-1} \cdot P^{1/2}] = [\rho^{-1/2} \cdot P^{1/2}] \quad [3.81]$$

$$[l] = [L_x] \quad [3.82]$$

$$[p] = [P] \quad [3.83]$$

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$$[C_u] = \left[ \frac{H}{M_g \cdot K} \right] = [L_x \cdot L_y^{-2} \cdot L_z^{-2} \cdot \rho^{-1} \cdot P \cdot C^{-2}] \quad [3.84]$$

Notes, with:

$$k = c \cdot m^a \cdot N^b \cdot v^c \cdot l^d \cdot p^e \cdot C_u^f \quad [3.85]$$

$$L_x^2 = L_x^{a-b+d+f} \quad \text{with} \quad a-b+d+f = -2 \quad [3.86]$$

$$L_y^{-2} = L_z^{-2} = L_y^{a-b-2f} \quad \text{with} \quad a-b-2f = -2 \quad [3.87]$$

$$\rho^{-1/2} = \rho^{a-\frac{c}{2}-f} \quad \text{with} \quad a-\frac{c}{2}-f = -\frac{1}{2} \quad [3.88]$$

$$P^{3/2} = P^{\frac{c}{2}+e+f} \quad \text{with} \quad \frac{c}{2}+e+f = \frac{3}{2} \quad [3.89]$$

$$C^{-2} = C^{-2f} \quad \text{with} \quad 2f = 2 \quad [3.90]$$

$$a=1, \quad b=1, \quad c=1, \quad d=1, \quad e=0, \quad f=1 \quad [3.91]$$

$$k = c \cdot m \cdot N \cdot v \cdot l \cdot C_u \quad [3.92]$$

Since  $m \cdot N$  is the gas density,  $d$ , and  $v$  is proportional to  $K$ ,

$$K = c \cdot d \cdot K \cdot l \cdot C_u \quad [3.93]$$

**Experiment confirms that thermal conductivity is proportional to absolute temperature. Surprisingly, experiment also confirms that thermal conductivity is independent of pressure ( $e = 0$ ).**

The *SI* “amount of substance,” the mole, and Avogadro’s number  $N_a$ , have a relationship to mass,  $M$ . Scrutiny of the “dimensional independence” of  $M$  would be incomplete without investigation of  $N_a$ .

### **3.11 AVOGADRO’S NUMBER AND MASS**

Avogadro’s number,  $N_a$ , is defined as the number of atoms in a gram-mole of carbon-12. In *SI* parlance it is: “the amount of substance in a system that contains as many elementary entities as there are atoms in 0.012 kilograms of carbon 12.” An *SI* directive gives the example: “1 mole of  $H_2$  contains about  $6.022 \cdot 10^{23}$  molecules or  $12.044 \cdot 10^{23}$  H atoms.” The *SI* value for  $N_a$  is listed (2011-2012) as  $6.02214179 (30) \cdot 10^{23} \text{ mol}^{-1}$ .

**There is an obvious contradiction here.**

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A hydrogen atom does not have exactly 1/12 the mass of a carbon-12 atom.

The ratio  $12 \frac{M_h}{M_c}$  is about 1.00782503207(10). The number of atoms in 1 gram-

mole of  $H_1$  is not the same as the number of atoms of  $^{12}C$  in 1 gram-mole. It

takes fewer hydrogen atoms to make a gram-mole of hydrogen. To deal further

with this complication, it is first necessary to establish a **new unit (NU) of**

**mass**, introduce a constant  $t$ , the **time thickness constant**, and develop an

alternative to Avogadro's number on a new unit of mass,  $NU[M]$ .

We have suggested that the gas constant,  $R_g$ , has the dimensions of density.

$$[R_g] = [\rho] = \left[ \frac{M}{L^3} \right] \quad [3.94]$$

In *SI* units,  $R_g = 8.314472(15)$  Joules/mole<sup>o</sup>K. Because a conversion factor

from *NU* to *SI* has been established, there is the possibility of approximating a

mass conversion factor ( $M$ ). The new unit (NU) of length is, by definition, the

radius of a unit vacuole,  $r = 1 = 1NU[L] = 1(L)$ . The square-bracketed  $[L]$  is

simply a dimensional statement. The  $(L)$ , in parentheses, is a conversion factor

from *NU* to *SI*.

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From [3.64] and [3.65], since  $(L) = 5.006148 \dots \cdot 10^{-13}$  m,  $(M) = R_g \cdot L^3$ , and  $(M) = (8.314472 \cdot 10^7)(5.006148 \dots \cdot 10^{-13})^3 = 1.043147 \dots \cdot 10^{-23}$  grams. This supposes, of course, that  $1 \text{ NU}[\rho] = 1$ . If we chose  $2 \cdot \pi$  as a  $\text{NU}[\rho]$  (good reasons for this!),  $(M) = 1.6602 \dots \cdot 10^{-24}$  g/ $\text{NU}[M]$ .

The inverse of this (approximate) mass conversion factor  $(M)$  is  $6.02337 \dots \cdot 10^{23}$ . If we assign the letter  $N$  to this inverse mass,  $\frac{N}{N_a} = 1.0002$ .

This “**coincidence**” will be developed further as the speculative source of this writing is developed.

### 3.12 THE TIME THICKNESS CONSTANT $t$

In exploring the dimensions of length  $[L]$ , we made use of the dimensionless fine-structure constant,  $\alpha = 7.2973525376(50) \cdot 10^{-3}$  (from 2011-2012 CRC Handbook). Arguments not presented at this stage require development of the concept of a time-thickness of the 3-dimensional (3-D) Universe in which we find ourselves. If we regard time as a fourth dimension right-angled to up-down, east-west and north-south in a 4-D space, we can recognize that our perception

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of time is not instantaneous. There is a distance in time, very small, but real, that appears subjectively as **the duration of the present instant**. In finding a conversion factor  $NU[T]$  to m/s, the velocity of light was used to convert centimeters to seconds and vice-versa, **giving a dimensionless value for light velocity as a ratio between two units of length**, the meter and the second.  $c = 2.99792458 \cdot 10^8$  is a conversion factor from seconds to meters.

Using thermal quantities, we estimated a conversion factor  $M = 1.6602 \cdot 10^{-24}$  grams/ $NU[M]$ . We have also found a conversion factor  $L = 5.0061 \dots \cdot 10^{-9}$  m/ $NU[L]$ . From these, we estimated a conversion factor  $\rho = 1.3233 \cdot 10^7$  g/cm<sup>3</sup>/ $NU[\rho]$  or  $\rho = 1.3233 \cdot 10^{13}$  g/m<sup>3</sup>/ $NU\left[\frac{M}{L^3}\right]$  and an estimate of the gas constant  $R_g = 8.3144 \cdot 10^7$  g/cm<sup>3</sup>/ $NU[\rho]$ .

A sphere with mass  $M$  and radius  $L$  has a density with dimensions  $[\rho] = \left[\frac{M}{L^3}\right]$  and a surface area with dimensions  $[L^2]$ . If the time thickness referred to above has dimensions  $[L]$ , it must be related to the radius of the unit sphere by a dimensionless constant. If the time thickness reveals itself as a measured wavelength,  $l$ , of electromagnetic character,  $l = t \cdot d$  or  $2 \cdot t \cdot r$ , where  $d$  is the diameter and  $r$  the radius of the unit sphere.

As a speculative hypothesis, put  $l = l_{ec}$ , the Compton electron wavelength (aka the Dirac wavelength). Then

$$l_{ec} = 2 \cdot t \cdot r \quad [3.95]$$

and

$$t = \frac{l_{ec}}{2r} = \frac{2.4263102175(33) \cdot 10^{-12}}{2 \cdot 5.006148 \cdot 10^{-13}} = 2.42332... \quad [3.96]$$

**Equation [3.95] is the basis for our discussions in Chapter 6 and illustrations in Figures 6-1, 6-2, 6-3, 6-4, 6-5 and 6-7.**

The time thickness constant is related to the fine structure constant,  $\alpha$  :

$$t = \frac{1}{2 \cdot 3^2 \cdot \pi \cdot \alpha} = 2.423322 \quad [3.97]$$

and can replace  $\alpha$  in calculating the conversion factor ( $L$ ):

$$L = 2 \cdot 3^2 \cdot \pi^2 \cdot \alpha^2 \cdot a^0 = \frac{a^0}{2 \cdot 3^2 \cdot t^2} = 5.006148 \cdot 10^{-13} m / NU [L] \quad [3.98]$$

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Selection of carbon-12 as the basis for a unit of “amount of substance” is completely arbitrary. Avogadro’s number,  $N_a$ , can be replaced with any reasonable number without loss of truth or meaning. Accordingly, we suggest that  $N_a$  be replaced through the relation  $M$  :

$$M = 2^7 \cdot t^3 \cdot m_e = 2^7 \cdot t^3 \cdot [9.10938215(45) \cdot 10^{-28}]g / NU[M] \quad [3.99]$$

The following factors  $NU$  to  $SI$  have now been established:

$$t = 2.423322 \quad [3.100]$$

$$L = 5.006148 \dots \cdot 10^{-13} m / NU[L] \quad [3.101]$$

$$T = 1.669872 \dots \cdot 10^{-21} s / NU[T] \quad [3.102]$$

$$M = \rho \cdot L^3 = 1.659629 \dots \cdot 10^{-24} g / NU[M] \quad [3.103]$$

$$N = \frac{1}{M} = 6.02337 \cdot 10^{23} \text{ unit spheres/g} \quad [3.104]$$

$$P = \frac{M}{L \cdot T^2} = 1.188888 \dots \cdot 10^{28} \text{ pascal} / NU[P] \quad [3.105]$$

$$\rho = \frac{M}{L^3} = 1.322817 \dots \cdot 10^{13} g / m^3 / NU[\rho] \quad [3.106]$$

$$\text{Gas constant } R_g = 2 \cdot \pi \cdot \rho = 8.311523 \dots \cdot 10^{13} g / m^3 / NU[\rho] \quad [3.107]$$

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$$\text{Electron mass } m_e = 2^7 \cdot t^3 NU[M] = 9.10938215(45)\dots \cdot 10^{-31} kg$$

[3.108]

### 3.13 THE CONSTANTS OF PHYSICS

It is now possible to calculate  $NU$  values for the constants of Physics and their  $SI$  equivalents using the relationships:

$$L_{ec} = 2 \cdot t \cdot L = \frac{h}{m \cdot c} \quad [3.109]$$

$$\alpha = \frac{1}{2 \cdot 3^2 \cdot \pi \cdot t} = \frac{2 \cdot \pi \cdot e^2}{h \cdot c} \quad [3.110]$$

$$N = \frac{1}{M} = \frac{1}{2^7 \cdot t^3 \cdot m} \quad [3.111]$$

$$c = \frac{L}{T} \quad [3.112]$$

From [3.109]:  $h = 2 \cdot t \cdot L \cdot m \cdot c$  [3.113]

From [3.111]:  $m = \frac{1}{2^7 \cdot t^3 \cdot N}$  [3.114]

Substituting [3.112], [3.113] and [3.114] in [3.109]:

$$h = \frac{1}{2^6 \cdot t^2} NU \left[ \frac{L^2}{N \cdot T} \right] \quad \text{or} \quad NU [L^4 \cdot \rho \cdot C] = 2.660711\dots \cdot 10^{-3} NU$$

[3.115]

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$$h = 2.660711... \cdot 10^{-3} [L^4 \cdot \rho \cdot C] = 6.62606896(33) \cdot 10^{-34} \text{ js}$$

Substituting [3.112] and [3.113] in [3.110]:

$$e^2 = \frac{h \cdot c}{2^2 \cdot 3^2 \cdot \pi^2 \cdot t} = \frac{1}{2^8 \cdot 3^2 \cdot \pi^2 \cdot t^3} NU \left[ \frac{L^3 \cdot M}{T^2} \right] \quad [3.116]$$

Thus 1 *NU* of quantity of electricity, *Q* is:

$$Q = e = \frac{1}{\sqrt{2^2 \cdot 3^2 \cdot \pi^2 \cdot t}} = \frac{1}{\sqrt{2^8 \cdot 3^2 \cdot \pi^2 \cdot t^3}} NU \left[ \sqrt{\frac{L^3 \cdot M \cdot k}{T^2}} \right] = 1.757887 \cdot 10^{-3} NU [L^2] \quad [3.117]$$

$$Q = e = \frac{1}{2^4 \cdot 3 \cdot \pi \cdot t^{3/2}} \cdot (L^2 \sqrt{P}) \text{ mgsSI}$$

$$Q = e = 4.803204... \cdot 10^{-14} \text{ mgsSI} \quad \text{taking } k=1 \quad [3.118]$$

Compare the 2011-2012 *S*/*I* value  $1.602176487(40) \times 10^{-19} \text{ C}$ .

**There is no need for a unit of quantity of electricity in the *NU* system.**

The conversion factor ( $L^2 / P$ ) is necessary instead of ( $L^2$ ) because, while *k* has dimensions  $[1/P]$ , its numerical value is 1. The difference between  $N_a$  and

$N$  ( $\frac{N}{N_a} = 1.0007204$ ) shows up in all quantities with *N* in dimensional

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statements; for example, the Faraday,  $F = e \cdot N$ , the Boltzmann and Stefan constants, and all other thermal quantities are sometimes, in subtle ways, difficult to detect. It happens that if Cesium-133 had been chosen instead of Carbon-12 in the calculation of  $N_a$ , the ratio  $N/N_a$  would be 1.000009, a difference of about 9 parts per million.

**It seems that the attempt to establish an exact scale of atomic mass units is a mistake. This provides a reason to doubt that mass is a “dimensionally independent quantity” and supports the proposition that the proper dimensions of mass are  $[\rho \cdot L^3]$ .**

### 3.14 DIMENSIONS AND CONVERSION FACTORS

In the  $NU$  system, physical quantities are written in the form:

$$\text{Mass of brick} = m_b = 1.205 \dots \cdot 10^{27} \text{ } NU[M]$$

This should be read “the mass,  $m_b$ , of the brick is 1.205 times  $10^{27}$  new units of mass, expressed to 4-figure precision. The  $[M]$ , in square brackets, is a dimensional statement. To convert from  $NU$  to  $SI$  or another system requires

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the use of conversion factors. These have been estimated for length, density, pressure, and (secondarily) for mass and time. Conversion is written thus:

$$mb = 1.205 \cdot 10^{27} \text{ NU} [\rho \cdot L^3] = 1.205 \cdot 10^{27} (\rho \cdot L^3) \text{ g} \quad [3.119]$$

The conversion factor  $(\rho \cdot L^3)$  has been estimated at  $1.659 \cdot 10^{-24}$  grams per  $\text{NU}[M]$ . The mass of the brick (remember it?) is then  $m_b = 1.205 \dots \cdot 10^{27} \text{ NU}[M] = 1.205 \dots \cdot 10^{27} \times 1.659 \dots \cdot 10^{-24} \text{ g} = 2000 \dots \text{ g}$ .

In some instances, the dimensional statement and the conversion factor are not exactly the same. An example is the statement for unit charge,  $e$ .

$$\text{In SI, } [e] = \left[ \frac{\sqrt{L^3 M k}}{T} \right]$$

$$\text{In NU, } [e] = [L^2]$$

But the conversion factor from  $\text{NU}$  to  $\text{SI}$  is  $(L \sqrt{P})$

This is due to the substitution of  $\sqrt{1/P}$  for  $\sqrt{k}$ , as explained previously. Another example is the conversion factor for the gravitational constant,  $G$ . In  $\text{SI}$ ,

$$[G] = \left[ \frac{L^3}{M \cdot T^2} \right].$$

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In  $NU$ ,  $[G] = \left[ \frac{1}{P \cdot L^2} \right]$ , but the conversion factor is  $\left( \frac{C^4}{P \cdot L^2} \right)$ , with a correction  $N / N_a$ .

In this case,  $C^4$  is numerically the unity, but must be included for dimensional Homogeneity. Necessity for the correction factor involving  $N = \frac{1}{M}$  is due to the arbitrary selection of carbon-12 as the basis for the *SI* unit of “amount of substance.”

### 3.15 AVOGADRO'S NUMBER, $N_a$ , AND $(1/M) = N$

Both Avogadro's number,  $N_a$ , “the number of elementary entities as there are atoms in 0.012 kilograms of carbon-12” and  $N = \frac{1}{M}$  have dimensions [number/mass]. There are, however, subtle differences. Avogadro's number is best measured by electrolysis of a silver solution, not of a carbon solution. The ratio of atomic mass to mass number for carbon-12 is exactly 1.0000... This ratio for silver is 0.9991... For hydrogen-1, the ratio is 1.0079... The number  $N_a$  differs from  $N = \frac{1}{M}$  in that it is an arbitrary constant unrelated to the mass of the particles it counts, whether they be atoms or molecules... or ships or shoes!

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The ratio  $N = \frac{1}{M}$  would be identical to  $N_a$  only if masses of all atoms were independent of their mass numbers, and if an elemental isotope were chosen (e.g., to replace carbon-12) for an elemental standard with a ratio (i.e., atomic mass/mass number) such that the new value for  $N_a = \frac{1}{M}$ . A decision that the conversion factor  $M = 1.659345\dots\cdot 10^{-24}$  g/NU[M] could be derived from the electron rest mass was, of course, also arbitrary. The first efforts to find the best value for  $M$  took place when the oxygen-16 base was in favor. Then,  $N_a = 6.025\dots\cdot 10^{23}$  g/mol. Now  $N_a = 6.022\cdot 10^{23}$  g/mol. This approach led to complications, but also to an awareness of subtle difficulties. In electromagnetic,  $N_a$  is useful. In thermal and dynamic situations it is better to recognize that mass is essentially a secondary approximate unit and that its components must be considered in any fundamental scheme.

Table 3.4 shows the many values of  $N$ . The symbol (\*) denotes that the gravitational constant depends on the cosmic abundance of elements, largely hydrogen and helium;  $k$  is the Boltzman constant;  $\sigma$  is the Stefan Boltzmann

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constant;  $N$  is the number of **unit vacuoles** per gram; and  $N_a$  is the number of atoms in a gram-mole of carbon-12.  $N$  may be assigned differing values depending on the elements or functions in which it is used.  $1/N$  may replace  $M$  when appropriate.

**Table 3.4.** The many values of  $N$

Element or Constant	$U$ or $f()$	$N \cdot 10^{23}$
${}^0_1\text{n}$ (neutron)	1.0086649	5.970404
${}^1_1\text{H}$ (Hydrogen-1)	1.007826	5.975379
$\text{p}^+$ (proton)	1.0072765	5.978633
$G = 2 \left( \frac{N \cdot T^2}{L} \right) = 6.67428(67)$ $\cdot 10^{-11} \text{m}^3 \text{kg}^{-1} \text{s}^{-2}$ SI units		5.98966 (see note 1)
$k = 2 \cdot \pi \left( \frac{\rho}{N} \right) =$ $1.3806504(24) \cdot 10^{-23} \text{JK}^{-1}$ SI units		6.01894 (see note 2)
$\sigma = (2^{23} \cdot \pi^3 \cdot t^6) / 15 \left( \frac{D^5}{C^5} \right) =$ $5.670400(40) \cdot 10^{-8} \text{Wm}^{-2} \text{K}^{-4}$ SI units		6.01941 (see note 3)
${}^{12}_6\text{C}$ (Carbon-12)	12.00000000	6.0221367... (Na)
${}^{207}_{83}\text{Bi}$ (Bismuth-207)	206.98037	6.0227023
${}^{133}_{55}\text{Cs}$ (Cesium-133)	132.905429	6.0264218
$N = \frac{1}{M}$	1.0007204	6.0264751 (see note 4)
${}^{127}_{53}\text{I}$ (Iodine-127)	126.904473	6.0266698
${}^{59}_{27}\text{Co}$ (Cobalt-59)	58,933198	6.0289629

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Note 1:  $G$ , the gravitational constant depends on the cosmic abundance of elements, which are predominately hydrogen and helium.

Note 2:  $k$  is the Boltzmann constant.

Note 3:  $\sigma$  is the Stefan Boltzmann constant.

Note 4:  $N$  is the number of unit vacuoles per gram.  $N_a$  is the number of atoms in a gram-mole of Carbon-12 per mole.  $N$  may be assigned differing values depending on the elements or functions in which it is used.  $1/N$  may replace  $M$  when appropriate.

### **3.16 COMPARISON BETWEEN THE 2-DIMENSIONAL SYSTEMS $LMTkN_a$**

**and  $LP\rho CN$**

At this stage, useful physical quantities should be summarized and their dimensions compared, as they will have many applications; see table 3.5. The  $LP\rho CN$  system more clearly reflects the nature of many of the quantities, especially electromagnetic quantities.

**Table 3.5.** Comparison of dimensional systems

Physical Quantity	$LMTkN_a$	$LP\rho CN$
Action (angular momentum)	$\frac{L^2 \cdot M}{T}$	$L^4 \cdot \rho \cdot C$
Avogadro's Number	$N_a$	
Bohr Magneton	$\frac{L^{5/2} \cdot M^{1/2} \cdot k^{1/2}}{T}$	$L^3$
Density	$\frac{M}{L^3}$	$\rho$
Electric Charge	$\frac{L^{3/2} M^{1/2} k^{1/2}}{T}$	$L^2$
Electric Current	$\frac{L^{3/2} \cdot M^{1/2} \cdot k^{1/2}}{T^2}$	$L \cdot C$
Electric Permittivity	$k$	$\frac{1}{P}$
Electric Resistance	$\frac{T}{L \cdot k}$	$\rho \cdot C$
Energy	$\frac{L^2 \cdot M}{T^2}$	$M \cdot C^2 = L^3 \cdot P$
Gravimetric Constant	$\frac{L^3}{M \cdot T^2}$	$L \cdot N \cdot C^2$
Inductance	$\frac{T^2}{L \cdot k}$	$L \cdot \rho$
Inverse Mass		$\frac{1}{\rho \cdot L^3}$ or $N$
Length	$L, L_x, L_y, L_z$	$L, L_x, L_y, L_z, L_t$

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Magnetic Field Strength	$\frac{L^{1/2} \cdot M^{1/2} \cdot k^{1/2}}{T^2}$	$\frac{P^{1/2}}{\rho^{1/2}} = C$
Magnetic Permeability	$u = \frac{1}{c^2 k}$	$\rho$
Mass	$M$	$\rho \cdot L^3$
Potential Difference	$\frac{L^{1/2} \cdot M^{1/2}}{T \cdot k^{1/2}}$	$L \cdot P$
Pressure	$\frac{M}{L \cdot T^2}$	$P$
Surface Tension	$\frac{M}{T^2}$	$L \cdot P$
Temperature (dynamic)	$\frac{L^2}{T^2}$	$C^2$
Temperature (kinetic)	1	1
Time	$T$	$\frac{\rho^{1/2}}{P^{1/2}} = \frac{L}{C}$
Velocity	$\frac{L}{T}$	$\frac{C}{c}$

### 3.17 THE CONSTANTS OF PHYSICS (e.g., $t = 2.423322\dots$ )

Table 3.6 shows useful physical constants with their conversion factors to new units  $NU$ , in which dimensions the of Time  $[T]$  and Mass  $[M]$  no longer play a direct, structural role. In the new system  $NU$ , all values for the fundamental physical constants are absolute, with the exception of the time-thickness constant.

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**Table 3.6.** New units  $NU$  and conversion factors

Physical Quantity	Value in $NU$	Conversion Factor	Official Value in SI units (2011-2012)
Bohr Magneton, $\mu_B$	$\frac{1}{2^5 \cdot 3 \cdot \pi^2 \cdot t^{1/2}} = 6.7798922 \cdot 10^{-4}$	$L^3 \cdot P^{1/2}$	$927.400915(23) \cdot 10^{-26} JT^{-1}$
Bohr Radius, $a_0$	$2 \cdot 3^2 \cdot t^2 = 1.057054613 \cdot 10^2$	$L$	$0.52917720859(36) \cdot 10^{-10} m$
Boltzmann Constant, $k$	$2 \cdot \pi$	$\frac{\rho}{N}$	$1.3806504(24) \cdot 10^{-23} JK^{-1}$
Electron Charge, $e$	$\frac{1}{2^4 \cdot 3 \cdot \pi \cdot t^{3/2}} = 1.757883944 \cdot 10^{-19}$	$L^2 \cdot P^{1/2}$	$1.602176487(40) \cdot 10^{-19} C$
Electron g-factor, $g$	1.001159652193	1	1.001159652193
Electron Radius, $r_e$	$\frac{1}{2 \cdot 3^2 \cdot \pi^2} = 5.628954647 \cdot 10^{-3}$	$L$	$2.8179402894(58) \cdot 10^{-15} m$
Electron Rest	$\frac{1}{2^7 \cdot t^3} = 5.489751035 \cdot 10^{-4}$	$M$	$9.10938215(45) \cdot 10^{-31} kg$

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Mass, $m$			
Faraday, $F$	$\frac{1}{2^4 \cdot 3 \cdot \pi \cdot t^{3/2}} = 1.7578839 \cdot 10^{-3}$	$L^2 \cdot P^{1/2} \cdot N$	$96485.3399(24) C mol^{-1}$
Fine Structure Constant, $a$	$\left[ 0.5 - \left( 0.25 - \frac{1}{137^2 \cdot g^{1/2}} \right)^{1/2} \right]^{1/2}$ $= 7.2973525376 \cdot 10^{-3}$	1	$7.2973525376(50) \cdot 10^{-3}$
Inverse Mass, $N$ $N_a$	1.00000000	$\frac{1}{M}$ $N_{avogadro} =$	$6.02337 \cdot 10^{23} g^{-1}$ $6.02214179(30) \cdot 10^{23} mol^{-1}$
Light Velocity, $c$	1.00000000	$\frac{L}{T}$	$2.99792458 \cdot 10^8 m/s$
Planck Constant, $h$	$\frac{1}{2^6 \cdot t^2} = 2.66069507 \cdot 10^{-3}$	$\frac{L^2 \cdot M}{T}$	$6.62606896(33) \cdot 10^{-34} Js$
Rydberg Constant, $R_\infty$	$\frac{1}{2^4 \cdot 3^4 \cdot \pi^2 \cdot t^3} = 5.4936105667 \cdot 10^7$	$\frac{1}{L}$	$10973731 \cdot 568527(73) m^{-1}$

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Stefan Constant, $\sigma$	$\frac{2^{23} \cdot \pi^9 \cdot t^6}{15} = 3.337615 \cdot 10^4$	$\frac{\rho^5}{C^5}$	$5.670400(40) \cdot 10^{-8} Wm^{-2} K^{-4}$
	$\frac{1}{2 \cdot 3^2 \cdot \pi \cdot a} = 2.423322$	1	2.423328345 Preferred value (see references 4 and 5 in vacuole hypothesis paper from COI)
Time Thickness,	$2 \cdot t = 4.846658901$	$L$	$2.426308377 \cdot 10^{-12} m$
Unit of Density, $\rho$	1.00000000	$\frac{M}{L^3} = \rho$	$1.32259236 \cdot 10^{13} g / m^3$
Unit of Length, $L$	1.00000000	$\frac{1}{2^4 \cdot 3^4 \cdot \pi^2 \cdot t^3 \cdot R}$	$5.00614635 \cdot 10^{-13} m$
Unit of Mass, $M$	1.00000000	$2^7 \cdot t^3 \cdot m$	$1.659344784 \cdot 10^{-24} g$
Unit of Pressure, $P$	1.00000000	$\frac{M}{L \cdot T^2} = P$	$1.18868673 \cdot 10^{28} pascal / NU [P]$
Unit of Time, $t$	1.00000000	$\frac{L}{C}$	$1.66997068 \cdot 10^{-21} s$

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Note that these conversion factors do not always show the actual dimensions of the quantities reported. Explanations are summarized in the following sections.

Table 3.7 may help the reader when comparing *NU* values with values from the *SI* system.

**Table 3.7.** New units *NU* and conversion factors to *SI*

To convert from:	To	Multiply by
NU[L]	centimeters	$5.00614634 \cdot 10^{-11}$
centimeters	NU[L]	$1.99754448 \cdot 10^{10}$
NU[M]	grams	$1.65934478 \cdot 10^{-24}$
grams	NU[M]	$6.02647512 \cdot 10^{23}$
NU[T]	seconds	$1.66987067 \cdot 10^{-21}$
seconds	NU[T]	$5.98848770 \cdot 10^{20}$
NU[P]	pascals	$1.8868673 \cdot 10^{27}$
pascals	NU[P]	$8.412645544 \cdot 10^{-28}$
NU[ρ]	grams/cm <sup>3</sup>	$1.32259236 \cdot 10^7$
grams/cm <sup>3</sup>	NU[ρ]	$7.56090864 \cdot 10^{-8}$

### 3.18 ELECTRONIC CHARGE, $e$

Conventional dimensions of  $e$  are  $[e] = \left[ \frac{\sqrt{L^3 M k}}{T} \right]$  or  $\left[ \frac{\sqrt{L M}}{u} \right]$  with  $L$  = length,

$M$  = mass,  $T$  = time,  $k$  = electric permittivity, and  $u$  = magnetic permeability.

The Vacuole Hypothesis puts the proper dimensions of  $e$  at  $[L^2]$ . Solving the equality:

$$L^2 = \frac{L^{3/2} \cdot M^{1/2} \cdot k^{1/2}}{T} = \frac{L^{1/2} \cdot M^{1/2}}{u^{1/2}} \quad [3.120]$$

gives:

$$[k] = \left[ \frac{1}{P} \right] \quad [3.121]$$

and

$$[u] = [\rho] \quad [3.122]$$

Permittivity has dimensions [1/Pressure], permeability has the dimensions of density and

$$c^2 = \frac{1}{u \cdot k} = \frac{P}{\rho} \quad [3.123]$$

For this reason  $P$  and  $\rho$  replace  $M$  and  $T$  as primary dimensions.

### 3.19 GRAVITATIONAL CONSTANTS $G_n$ and $G_r$

Dimensions of the Newtonian constant  $G_n$ ,  $\left[ \frac{L^3}{M \cdot T^2} \right]$  and the relativity

constant  $G_r$ ,  $\frac{T}{L \cdot M}$  differ by  $\left[ \frac{1}{c^4} \right]$  or  $\left[ \frac{T^4}{L^4} \right]$ . If one takes  $c^4 = 1$ ,

converting to the  $LP\rho$  system gives the conversion factor listed above. The value given  $N_g$  derives from the fact that the universe contains much more Hydrogen and Helium than Carbon-12.

### 3.20 TEMPERATURE DEPENDENT CONSTANTS, $k_b$

The Vacuole Hypothesis assigns dimensions  $\left[ \frac{P \cdot L^3}{\rho} \right]$  to temperature. This gives

the gas constant the dimensions of density and

$$k = 2 \cdot \pi \cdot NU \left[ \frac{\rho}{N} \right] = 1.3806504(24) \cdot 10^{-23} JK^{-1} SIunits \text{ on the Carbon-12 scale.}$$

### 3.21 CONCLUSION

In the new suggested system, all values for the “fundamental” physical constants are absolute, with the exception of the time-thickness constant,  $t$ .

Planck’s constant  $h = \frac{1}{(2^6 \cdot t^2)}$ , electron charge  $e = \frac{1}{\left(2^4 \cdot 3 \cdot \pi \cdot t^{\frac{3}{2}}\right)}$ , electron rest

mass  $m = \frac{1}{(2^7 \cdot t^3)}$ , light velocity  $c = 1$ , etc. A “best value” for  $t$ , 2.42332945...

has been estimated from the electron g-factor, experimentally determined to  $10^{-5}$  ppm<sup>57</sup>. Using these values, the fine structure constant

$$a = \frac{2 \cdot \pi \cdot e^2}{h \cdot c} = 0.0072973498\dots \text{ The 1986 value is } 0.00729735308(33).$$

A simple example may demonstrate the advantage of using the *LPpC* system instead of the *LMT* system. Solve the following:

**Problem:** Using the method of dimensions, determine the mass of viscous fluid flowing per second through a round tube.

***Solution using the LMT system***

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A complete summary of parameters is given in table 3.8.

**Table 3.8.** LMT system

Physical Quantity	Symbol	Dimensions
Mass per Second	$m$	$\frac{M}{T}$
Pressure Gradient	$p$	$\frac{M}{L^2 \cdot T^2}$
Density of Liquid	$d$	$\frac{M}{L^3}$
Coefficient of Viscosity	$n$	$\frac{M}{L \cdot T}$
Radius of Tube	$r$	$L$

Dimensionally, we have:

$$[M \cdot T] = \left[ \frac{M}{L^2 \cdot T^2} \right]^x \cdot \left[ \frac{M}{L^3} \right]^y \cdot \left[ \frac{M}{L \cdot T} \right]^z \cdot [L]^w = p^x \cdot d^y \cdot n^z \cdot r^w$$

whence

$$x + y + z = 1$$

$$2x + z = 1$$

$$w - 2x - 3y - z = 0$$

We have three equations and four unknowns. The best result we can find is:

$$x = \frac{1}{2} - \frac{z}{2}$$

$$y = \frac{1}{2} - \frac{z}{2}$$

$$w = \frac{5}{2} - \frac{3z}{2}$$

We must guess that  $z = -1$  to obtain the correct solution.

### ***Solution using the LPpC system***

A complete summary of parameters is given in table 3.9.

**Table 3.9.** LPpC system

Physical quantity	Symbol	Dimensions
Mass per second	$m$	$L^2 \cdot \rho \cdot C$
Pressure gradient	$\rho$	$\frac{P}{L}$
Density of liquid	$d$	$\rho$
Coefficient of viscosity	$n$	$\frac{P \cdot L}{C}$
Radius of tube	$r$	$L$

Dimensionally, we have:

$$[L^2 \cdot \rho \cdot C] = \left[\frac{P}{L}\right]^x \cdot [\rho]^y \cdot \left[\frac{P \cdot L}{C}\right]^z \cdot [L]^w$$

whence

$$w + z - x = 2$$

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$$z = -1$$

$$y = 1$$

$$x + z = 0$$

$$\text{and } x = 1, y = 1, z = -1, w = 4$$

giving the correct solution, mass per second  $m = (\text{a dimensionless constant})$

$$\times \frac{p \cdot d \cdot r^4}{n}.$$

The reason for *LP $\rho$ C* system's success is that it automatically takes the difference between  $M_i$  and  $M_g$  into account. In Huntley's treatment<sup>24</sup> of this example, he includes  $M_i$  and  $M_g$  in the *MLT* dimensional statement, thereby resolving the difficulty.

## PART 2. THE THEORY OF VACUOLES

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### INTRODUCTION

We have now reached the point where we have better tools to make progress in our mission. We should now develop a strategy that will help us to better focus on causes rather than effects; for this I will borrow ideas we created for the Theory of Sampling, in a completely different domain. It is interesting how you can sometimes get new ideas from totally unrelated fields.

Then, we will speculate on what may happen in the far ultraviolet in the domain of very high energy. It is my view this holds the key of many unsolved mysteries that puzzle us today.

Finally, we will elaborate on the full Theory of Vacuoles and apply it to the structure of atoms and make an attempt to explain why some atoms are stable and why some are not, which may explain some results from experiments leading to Low-Energy Nuclear Reactions.

## CHAPTER 4

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### A ROAD MAP

In a totally different domain in which a road map to good sampling practices was needed, a fundamental principle was introduced in the 80's, by Dr. Pierre M. Gy<sup>25</sup>, in which he emphasized the importance of making a clear difference between *Structural Properties* and *Circumstantial Properties*. At the time, it was a breakthrough for the *Theory of Sampling*.

A property is said to be *structural* when it necessarily results from a certain number of **conditions that we are in a position to control or quantify**, and that we assume to be fulfilled. It is what it is; it is the structure we operate with.

A property is said to be *circumstantial* when it depends on **conditions which we are not necessarily in a position to control**. It is a conjuncture. It is an effect that depends on chance or something else; it is a circumstance we have

to endure. Many people today consider Low-Energy Nuclear Reactions as the result of circumstantial properties; maybe we can change that opinion.

There is no doubt that during our search for our sub-quantum identity, a similar principle can be established, and it may make a huge difference in our ways of thinking when using the *Theory of Vacuoles* to describe the Universe in which we live.

#### **4.1 DESCRIPTION OF A CIRCUMSTANTIAL UNIVERSE**

A Circumstantial Universe is the Universe we see, with particles, atoms, molecules, matter, size, distance, mass, speed, and time. It is what has been accessible to our senses ever since we were born, and it is the foundation of Newtonian Physics, basically, Sciences as most of us know them. We look at what is around us, near or very far away, and make desperate attempts to understand these things and learn how to live with them. It is the undeniable conjuncture in which we live, and a lot of it depends on local conditions and chance. In many ways, we endure that conjuncture by looking at it. It is us; it is me; and it is the world around me that I have to learn from. For many centuries we were trained to look at this conjuncture in a humble way, as if it was beyond our understanding to significantly modify it. In this process we became

excessively submissive and lost our focus on who we really are. What I see is the Universe around me. This is a paradigm we must eliminate because it is an unfair hurdle that limits us in scientific, philosophic, and even religious research. Let's be clear on this issue, on a clear night you can look at the Universe and make a rough picture of it from your observations; nevertheless, the way the Universe is at that instant of your observation has absolutely nothing, anywhere close, to do with what the Universe may be at this instant, today. We look at a time-distance illusion of incredible proportion: we just don't know how to observe the truth.

## 4.2 DESCRIPTION OF A STRUCTURAL UNIVERSE

The *Vacuole Theory* suggests there are no such things as particles, atoms, molecules, matter, size, distance, mass, speed, and time **as we know them**. All this is the resulting effect of what we can see, touch, feel, hear, and smell, but is at a far grander scale that we ever imagined. The Structural Universe, or one of them, is an unknown, immaterial medium foreign to our senses; it is made of pure energy, waves, consciousness, Universal Entanglement or a mysterious form of it; and may have a very faint mass, but this is speculation and open for debate. **From unknown stimuli**, this primordial medium creates vacuoles within itself. In this process, waves are infinitely compressed into a thin shell of the

same medium around a perfectly empty space. The center part of the vacuole, or **perfectly empty space**, is not accessible to anyone or anything. However, the compressed shell that surrounds the nothingness gives the illusion of being a particle. In fact, the *Structural Universe* is made only of waves, with many different amplitudes, frequencies, periods, and of perfectly empty vacuoles. There are vacuoles of several sizes (i.e., particles) and assemblages of vacuoles of many kinds (i.e., atoms). The reason a so-called photon may sometimes look like a wave and, at other times, like a particle has nothing to do with reality. It is only a wave; sometimes we perceive it as being a particle because of what we can observe, like a ghostly, extremely elusive part. It is our circumstantial perception (i.e., how we observe) that creates this duality; however, there is a fundamental difference.

### **4.3 BREAKING THE PARADIGM IN WHICH WE ARE PRISONER**

The Universe is comprised of waves, and only waves, from sound, radio, television, infrared, visible light, x-ray, gamma rays,... all the way to an intriguing limit, far away, in the unexplored domain beyond the ultraviolet, and those waves created at extremely high temperatures. Near that thermal limit (the Plank temperature) an embarrassing mystery resides; it is called the “ultraviolet catastrophe,” a temperature where nothing behaves “normally,” where even the

## The Theory of Vacuoles and LENR

Planck constant may start behaving differently<sup>2</sup>. It is my view the domain beyond the “ultraviolet catastrophe” may hold the secret of how vacuoles were and are still being created. It is time to give this mystery top priority in our search for the truth we all seek, because it is definitely a structural property; we can learn how to study it more effectively and most certainly we should learn how to quantify it.

### **4.4 ETHER MADE OF PURE ENERGY, WAVES, AND A FORM OF CONSCIOUSNESS**

Many people may accept that the suggested *Ether* is pure energy and waves. But, many people may have a problem with the fact that *Ether* would have consciousness or, a form of it, which we could call Universal Entanglement. To them, the so-called atheists, it is inappropriate to integrate an act of faith with science because there is absolutely no way to verify such a thing. However, I am not so sure I would agree with them for many reasons. We may analyze this theory because it is most certainly worthwhile and, I would use only the statistical point of view to approach that problem.

Jacques Monod<sup>50</sup>, a very famous French biologist wrote a book titled *By Chance and By Necessity*. Monod was a bright scientist and an atheist. In his book, he demonstrated that chance or luck, as a random process in nature, has an

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essential role in biological evolution, which “proves” the absence of any “intention” anywhere in nature. As a result, he condemns the idea of any ancient human alliance with the Universe. In other words, he takes the viewpoint of the observer and completely ignores the viewpoint of a participant. This is typical of circumstantial viewpoints where man is an accident within an empty and cold Universe. I feel sorry for someone with such a viewpoint, which is by the way, like it or not, an act of faith as well.

The recent detection of life form possibilities throughout the entire Universe sheds doubt on Monod's views. Animated life is no longer separated from unanimated matter; day-by-day the clear separation between the two concepts is slowly vanishing. Now, we are forced to witness and analyze this mysterious ability of matter, as we know it, to organize itself well enough to constantly climb the ladder of complexity with stunning success. If you look at the propagation of morel mushroom mycelium within the top soil of a forest, you will see that it spreads one inch per day, to find the optimum place where a beautiful fruit will grow and, thence, propagate miles away, you would be humbled at nature with its stunning beauty and its deliberate entanglement capabilities: you would literally laugh at anyone pretending that it is all chance or luck. If you look at the new discoveries about mycelium properties in the environment, in the web of

## The Theory of Vacuoles and LENR

life, you would have to reach a high level of insanity to believe that there is no consciousness “guidance” at the level of particles, atoms and molecules (i.e., vacuoles)<sup>51</sup>. For example, when a mycelium decides to go from point A to point B in the forest, how does it always take the shortest/easier way between those two points when obstacles are placed between points A and B? Is it because of Universal Entanglement, consciousness, or what? We could mention the possibilities of life based on silicon, which, in that case I would bet anything that every planet in the Universe supports one form of life or another. If all that stuff could be explained by some kind of random process (e.g., Poisson Processes), such as the one illustrated in figure 8-6, then I would suggest the following question: why is it that nature does, in a majority of cases, decide by some enchanted ways that the best options are the ones to be selected? If this is by chance alone, I would rather be a “cobbler” than a sampling statistician, just to use an image similar to the one Einstein suggested once... But, oh no! This is just the sneaky design of the thousands of tiny Maxwell’s demons; I forgot! Let’s be serious, we have more important things to do than to listen to those who, through an arrogant act of faith, faith in what they believe the truth is, would say there is no such thing as Universal Consciousness or Universal Entanglement.

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A good scientist must have an open mind. In that case it would be much wiser to accept that Universal Consciousness is, indeed, a serious possibility and a structural property of the Universe. The facts to support this are many, undeniable, and, therefore, we don't have to accept Universal Consciousness as an act of faith at all. Learn to become a participant and you will see it all.

You may notice that throughout this essay we don't go too far in the use of complex mathematical models. There is a reason for this: it is extremely important to first develop an overall concept or vision of what reality is and, of course and by all means, we will then create mathematical models as a penetrating tool later on, but not now. The last thing we want to do is create complex equations all over the place and then, later on, wonder what their rationale really is. We also want to prevent a state of vagueness where all avenues are possible or probable but never certain; we want to prevent writing pages and pages to prove that, at the end of the day, we really had nothing to say that would make a serious difference for the world we live in today. Substantiated evidence is the essence, and certainly not convenient mathematical models!

## CHAPTER 5

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### EXPLORING MYSTERIES FAR BEYOND

#### THE ULTRAVIOLET

This chapter starts with a pertinent question: would it be conceivable that among the electromagnetic background (which, according to our speculation is the only thing there is), in-phase harmonic oscillators continually create local vacuums and, the only ones that are stable could be the ones corresponding to the Compton wavelength?

##### 5.1 THE IN-PHASE HARMONIC OSCILLATORS CONNECTION

The principle of superposition of very energetic waves taking place beyond the far ultraviolet spectrum may trigger the birth of electrons and positrons simultaneously, on a massive scale, when black holes, quasars, super novas, or other exotic objects in the Universe emit powerful rays. Apparently even lightning strikes in the earth atmosphere can do it.

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The time-thickness  $2 \cdot t \cdot r$  in our vicinity has been measured in units of length. It is the Compton wavelength of the electron, the **fundamental quantum**. A long time ago, Louis de Broglie, someone who I immensely respect, was heading in the same direction. Therefore, I would suggest the following plan of study which is beyond the limited scope of this essay; let's call this a possible, logical sequel to this essay.

Plan of study:

1. Study properties of in-phase harmonic oscillators and their mathematical models.
2. From quantum mechanics, study what happens near or at the Compton wavelength.
3. What happens when in-phase harmonic oscillators are created near that infinitesimally small fundamental quantum?
4. Is there a higher probability for in-phase harmonic oscillators to be created if the wavelength of the electromagnetic field becomes smaller and smaller and approaches the Compton wavelength?
5. This should lead to so-called stable "particles," such as protons, neutrons, electrons, etc.

6. Reconcile findings with Oliver Ingamells's vacuoles model: can vacuoles be created by in-phase harmonic oscillators carrying enormous energy?
7. We may conclude then that the creation of stable "particles" may be much easier than what we may think.
8. Read Charreton's theory of the "*corps noir*" again<sup>2</sup>.

This could lead to the fundamental mechanism that creates vacuoles, and always the same ones. Vacuoles created at longer wavelengths may be unstable and ephemeral or just impossibilities: we will probably create plenty of those in super colliders... with a ridiculously short life expectancy... so what?

## 5.2 PHOTONS OR NOT PHOTONS

"Gazes" of photons, positive and negative depending on their polarization, make up the "observable" part of the *Ether*. According to Charreton<sup>2</sup>, the original universe should have contained only photons and electrons. With the Theory of Vacuole, we can attempt to go one step further, if we assume that photons exist only in the fundamental background; we, therefore, must find the process that leads from *Ether* to photons and photons to electrons. The concept of a photon behaving as a wave and an entity, such as a particle, should be slightly revised with the Theory of Vacuole to something like: a photon is a fundamental

package of energy similar to its definition in the quantum theory. In other words, it is not per se, a particle, but a convenient amount of energy, capable of interacting with vacuoles. So, we should agree that the fundamental background, *Ether*, and photons are actually the same thing, but manifested in different ways. Perhaps, there is a subtlety that quantum mechanics has been very successful at analyzing; it is nothing more than a convenience.

### **5.3 PARTICLES OR NOT PARTICLES**

The big breakthrough, given by Louis de Broglie in 1923, was his suggestion that if matter and energy are different manifestations of the very same thing, and if the photon is defined as a particle of energy with an associated wavelength, then it would make sense for other particles such as electrons, positrons, protons, to also have wavelengths. The success of his proposition was, without any doubt, telling us that something very fundamental rules the components of matter as we know them. With the Theory of Vacuoles, the doubt is even less, as we define particles as vacuoles, the shell or edge of which, and its overall compartment, are ruled by waves and waves only. The word “edge” used instead of the word “shell” refers to some kind of event horizon.

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The conclusion is that, until we accept a necessary shift in paradigm, quantum mechanics tries to compare reality (i.e., the world of waves and only waves) with what does not exist (i.e., our perception that there are particles and therefore matter). In other words, quantum theory has been hiding a better way of how to define another level of physical reality.

When Oliver Ingamells first presented the Theory of Vacuoles to me in 1992, I took the position that it was only a speculation on his part; which I did not take seriously. Several years later, around 2006, when I revisited that speculation and placed it in the context of new developments in modern physics, such as String Theory, the Theory of Vacuoles was instantly promoted to the level of Theory of Vacuoles hypothesis as all of a sudden, it seemed that pure vacuum and waves had a somewhat attractive future together. Then, when I analyzed the "giveaways," listed in chapter 1, I suddenly reached a level of certainty, which clearly means the Theory of Vacuoles is no longer a hypothesis, but an undeniable necessity, leading to the necessity for a paradigm change in physics. Without that drastic change in paradigm, too many mysteries will remain inexplicable, so let's have the courage to do something somewhat different. Of course, many talented physicists around the world will have to help correct, polish, and complete our humble contribution.

## 5.4 THE GATES OF CREATION

A long time ago, Planck suggested his equation:

$$E = h\nu \quad [5.1]$$

where  $E$  is energy,  $h$  the famous Planck constant, and  $\nu$  a frequency. The ratio

$\frac{E}{\nu} = h$  is then the typical ratio of the energy carried by an oscillator and the frequency of the corresponding radiation. Charreton<sup>2</sup>, in his description of black matter, suggested that Planck's equation applies very well up to  $10^9$  degree Kelvin; however, it seems to drastically deteriorate as the temperature goes further up, all the way to  $10^{14}$  degree Kelvin, which actually appears to be an unsurpassable limit.

According to Charreton's theory, the electron and the photon are the only elementary particles there are, and everything else is a composite of them. Therefore any exchange of energy between a field of electrons and a field of photons necessarily involves exchange of energy between electrons and photons and nothing else.

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So, at very high temperatures, something unusual may take place, something very different from what we know. Is it conceivable that, when wavelengths become infinitesimally small and frequencies and energies extremely high, in-phase harmonic oscillators will become the rule? The compounding of harmonic waves adding height to each other may generate stunning levels of energy. Then, so-called photons may form into stable vacuoles, always the same vacuoles with which everything we see becomes possible.

Could it be the electron? But, if we accept such a hypothesis, it would suggest that *Ether* has, indeed, some physical properties of its own and it would be very useful to find out what they are (e.g., mass and temperature of coalescence). A long time ago, or maybe right now, according to the famous astronomer Fred Hoyle, the large-scale coalescence led, or may lead to the creation of electrons and positrons; it may still take place today as the ultimate product of black holes, super novas, electric storms, etc.

Then, all other “particles” or different vacuoles or assemblages of vacuoles, should always somewhat involve some energy exchange between *Ether* and its photons and electrons or positrons: they are the dynamic engine of the Universe we know.

Oliver Ingamells did not believe in the advantages of using large colliders, nevertheless, I believe that the Large Hadron Collider may witness *Ether* coalescence and, if it does, perhaps the Theory of Vacuoles will start to make sense... if we are willing to change the paradigm!

## **5.5 FROM IN-PHASE HARMONIC OSCILLATORS TO ELECTRONS AND POSITRONS**

This section is my speculation and was not initiated by Oliver Ingamells. There is another possibility: what if electrons and positrons were formed at the same time, at the same place, and in the same quantity? We know the positron can only exist as long as it does not come into contact with an electron or, at least, that is what we think. We know that, on contact, electrons and positrons annihilate each other and emit a wave, or so-called photon:

$$e^+ + e^- \rightarrow h \cdot \nu \quad [5.2]$$

where  $\nu$  is a frequency and  $h$  Planck's constant.

But, some experiments have shown the opposite reaction, where a high-energy photon created an electron-positron pair. Therefore, it is not unreasonable to

## The Theory of Vacuoles and LENR

imagine that beyond the "ultraviolet catastrophe," a domain of extremely high energy waves, waves that are so powerful that *Ether* can no longer sustain itself and constantly transforms itself into an infinite quantity of electron-positron pairs. I have illustrated that process in my simplistic sketches illustrated in figure 5-1 (I am but a mortal exploring possibilities), and then further developed in figure 5-2.

Of course, some pairs may self-annihilate after their formation, yet many electrons and positrons may start lives of their own in the Universe after they have moved far away from each other. Under extreme conditions, such as those found beyond the ultraviolet catastrophe, electrons and positrons may escape one another with no possible subsequent annihilation... or, is there a simpler and subtler explanation possible, as suggested by the poorly understood neutrino?

The question would be something like this: how do we go from a positron to a proton? The mass  $m$  of the proton is 1836 times the mass of the positron. Shall we accept the "quark" theory? Shall we wait on the super collider to find out what is inside the proton? There is absolutely nothing at all inside the proton as it is a vacuole floating in *Ether*.

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Perhaps there is another reason. I find it an intriguing coincidence that the proton and the positron would have exactly the same charge. Because hydrogen atoms are so common throughout the Universe and were apparently comprised of side-by-side electrons and protons, is it not unreasonable to think that electrons and protons were somehow created side-by-side at nearly the same time?

Another intriguing coincidence is the fact that, somehow, positrons disappeared. Would it be conceivable that under some conditions, still to be discovered, there is perhaps a way leading from a positron to a proton?

# The Theory of Vacuoles and LENR

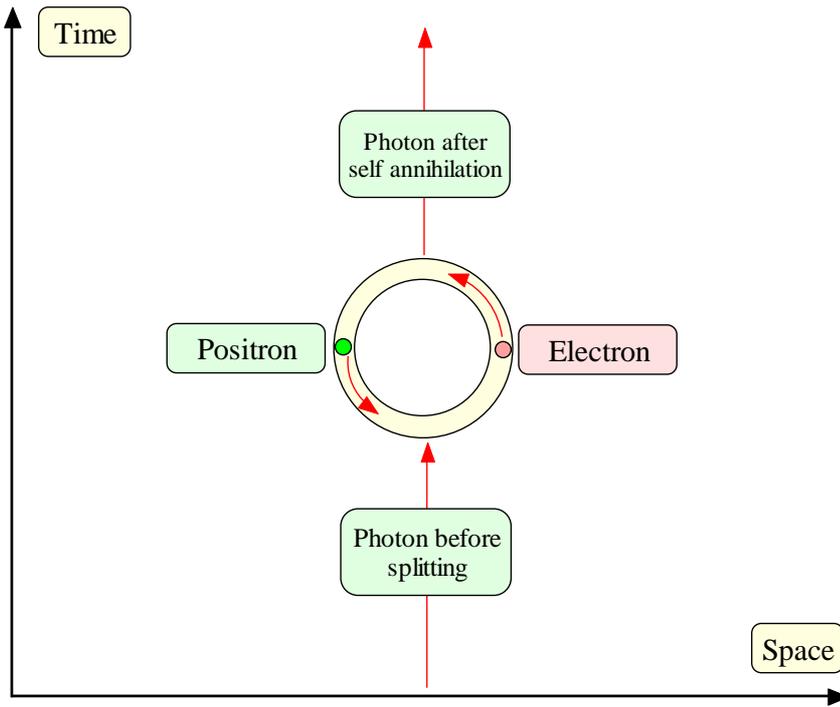


Figure 5-1. A photon creating an ephemeral electron and positron pair:

a confirmed scientific fact.

## The Theory of Vacuoles and LENR

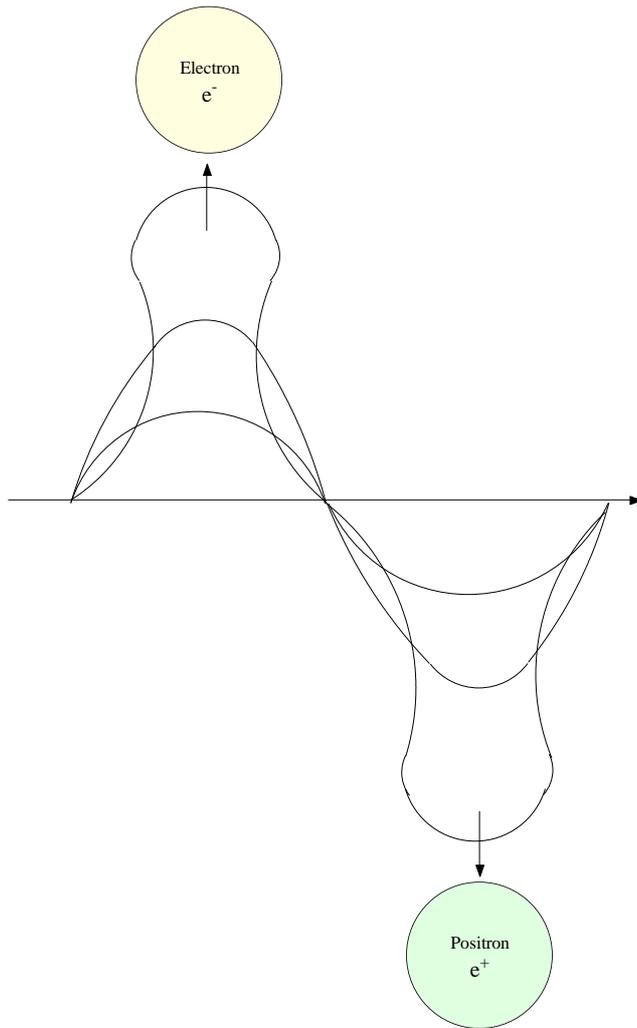


Figure 5-2. Beyond the “ultraviolet catastrophe:” from extreme energy created by wave superposition to the formation of electrons and positrons, or the “coalescence” of the universal “stuff.”

## The Theory of Vacuoles and LENR

Another consideration going back to something Albert Einstein once said: “mass is a form of energy and nothing else.” This suggests that the more a vacuole, made of waves, vibrates the more energy it possess and, therefore the greater the mass. Would it be conceivable that we can change a positron to a proton just by changing the way the positron is vibrating? Is there any mechanism in nature that would allow that metamorphosis from a low vibrating rate to a much higher one? Or, perhaps, as suggested later by Oliver Ingamells, **there is another, much simpler, explanation**; we will get there in due time.

### 5.6 ANOTHER INTRIGUING POINT

The neutron’s home is at the center of an atom and, as such, it is very stable. However, when, for some reason, a neutron is expelled from the center of an atom, its life is very short, just a few minutes. When the neutron decays, it transforms itself into one proton and one electron. This further suggests that there must be a very close relationship between electrons and protons, which brings us back to the tight relationship between electrons and positrons. This is just food for thought, as we may make an attempt to analyze this relationship in terms of vacuoles instead of particles.

**Actually, at the end of this essay, when we will analyze the implications of the vacuole hypothesis, we will clearly state that proton and positron are the same thing, but seen within a different n-dimensional universe.** Therefore, the connection that we suspect is well-founded and encouraging.

### **5.7 THE TIME THICKNESS**

The universe, of which we are physically a part, is a three-dimensional “slice” of the n-dimensional Universe, confined by parallel hyperplanes that are separated by a distance we call the time-thickness  $2 \cdot t \cdot r$ . In subjective terms, the time-thickness appears to us as **the duration of the present instant**. Then, we may define the unitary time-thickness as  $dt$ , the very basic, very small increment of a differential; from there we are back to Quantum Mechanics, which by all means provides very clever ways to analyze the problem in depth. Then, you may say, so what? **We do not argue about the tools used to analyze the problem; we argue about the formulation of the questions to be answered.**

### **5.8 THE DANCE OF VACUOLES**

In the Vacuole Hypothesis, the electron is simply a vacuole, therefore, it is never a particle, but an agglomerate of waves organized in some way. These waves are part of the only existing universe and are universally entangled. As a result,

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there are no parts unaware of what other parts are doing, which should be rephrased outside our paradigm: “I am aware of myself,” the universe talking... or thinking; remember, someone already suggested the universe was no longer a big machine, but rather a big thought.

Therefore, it should not come as a surprise that vacuoles are capable of appearing at many places at once and also capable of making “impossible” leaps, which should be rephrased properly outside our paradigm. “I am what is; I am one; I am everywhere at once! The vacuole here is the same as the vacuole there; here and there are the very same place. The infinite growing and the infinite shrinking are the very same thing.”

As a result quantum mechanics, with its weaknesses, is far closer to the truth than classical physics. However, the fact that when waves collapse at the instant of an experimental measurement seems to be a simplistic concept that needs to be properly rephrased outside our paradigm. Ergo “the measurement is the apparent picture of massive assemblages of vacuoles; they have no reality. As a result, the measurement cannot and will not see the waves making everything apparent. There is no wave collapse. What is collapsing is our profound consciousness trying to make sense of an imaginary reality visible to

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us within our paradigm.” In other words, the monkey stubbornly refuses to evolve.

In classical physics, electrons are separated from one another. In the vacuole hypothesis, all vacuoles, throughout the Universe, are connected because they are floating within that which is the “one,” which is *Ether*.

The concept has mind boggling implications, but most certainly can explain many mysteries observed in nature. Basically, there is no need for local entanglement or for particles to be at several places at once; these old concepts just make things unnecessarily complicated, though they provide partial explanations that make a lot more sense in classical physics. In many ways, physicists and mathematicians are very clever at creating imaginings that are necessary to counter illusions created by our incorrect paradigm. It is likely they will finally discover the absolute necessity to change the paradigm that limits them so badly; then, and only then, will their new-found knowledge lead them to discover the infinite possibilities that await us... perhaps rather quickly. I cannot wait!

## **5.9 THE BEST IS YET TO COME.**

At the end of this chapter we have been left with an unsated and unbounded hunger, wondering if there is any connection between a positron and a proton: I understand the thought may appear silly to many. However, later on, we will propose the answer, with certainty, with unambiguous proof; therefore, the Theory of Vacuoles must be far more than a hypothesis. In due time, the reader should reach peace of mind, and conclude he or she may not have lost his or her time.

## CHAPTER 6

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### THE BASIC PRINCIPLES

The Theory of Vacuoles, which should be correctly called at this stage a Vacuole Hypothesis begins with a simple axiom:

**If there is absolutely nothing between two entities, neither of them can effect nor have knowledge of the other.**

From this axiom, it seems necessary that our universe must be a single continuous entity, for if it were not so, parts of it would be outside of it, and beyond our vision or contemplation. Thus, "space," as we know it, cannot be emptiness. On the Grand Scale, this means that God, however we define it, her, him, Him, They, Light, Ra, Allah, Jesus, Viracocha, or Taaroa, and whether or not we admit that it, she, he, exists, God is not separate from the Universe, but an integral component of it. On the scale of this little, troubled earth, each one of us (i.e., mortal) is not only a part of our earth, but a part of the Universe, and, hence, a part of God; this is plain Cartesian logic, therefore, good science. This

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is a beautiful concept that should make us proud, happy, humble, and most certainly peaceful in everything we conceive and do. In such a view, the concepts of birth and death take a huge blow as we can perceive their awesome naivety, and genuine, eternal love is the logical substitute... perhaps not so Cartesian! This is a science version of our essay, therefore, we leave that intriguing subject to the reader's further private thoughts; what a nice subject for conversation on a summer night with many stars and a glass of wine!

At the atomic level, the same axiom and the same reasoning apply. Every particle, every atom, is a part of and fulfills its small place in the functioning of not only the organism or artifact in which it finds itself, but the entire Universe. Any entity we perceive as a "particle" must be continuous with the Universe within which it exists. If the particle is engendered by a vacuole, its essential property is the "shell" of the vacuole, which is nothing more than a local edge, more compressed and more energetic perhaps, of the Universe; it is like a force from within, where there is nothing at all, directed toward the *Ether*, and compressing it on the edge: this is energy, **and a lot of it**. It is energy in storage.

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Given the above speculation, the possibility appears that the nuclei of atoms are engendered by assemblages of vacuoles, the surfaces of which are related to the positive charges on their nuclei. Similarly, the unstable strongly-interacting “particles” may be so constituted. To investigate this possibility, attention was directed to the periodic table of the elements; the fact that atomic weights and numbers increase in increments (i.e., quanta) was accepted without explanation, with the hope that an explanation would developed later. After many false starts, the picture shown in figure 6-1 emerged. It was first published in preliminary form in 1967 and further developed in print in 1971, 1981, and 1983<sup>19,20,21,26</sup>.

Through the centuries, Science, which is supposed to represent our understanding of the Universe, has developed through repeated crises, even wars, during each of which an “*Establishment*” had to be reorganized or overthrown. The ideas expressed and developed in this essay are not entirely new, nor are they entirely my own (Oliver Ingamells speaking). They have been brewing in the minds of the many who see fatal flaws in existing standard models. In this essay we developed a new dimensional and unitary system (*NU*) that may lead to better perception of the atom, life, the world and the Universe. In other words, it should help us to liberate ourselves from a very old paradigm.

## 6.1 STATEMENT OF THE VACUOLE HYPOTHESIS

The Vacuole Hypothesis may be summarized in **ten articles** or propositions, as follows:

1. The UNIVERSE is a single continuous n-dimensional entity, made of a never-ending, all-pervasive “stuff” and nothing else. This “stuff” may be called space-time, Ether, God, the sub-quantic medium, the structured vacuum, Universal Entanglement, etc... Its important feature is that **it is all there is: there is nothing else**. The reader should meditate on this statement; it has huge implications. It is the key to an essential Scientific paradigm shift.
2. The universe, of which we are physically a part, is a three-dimensional “slice” of the four-dimensional UNIVERSE, confined by parallel hyperplanes separated by a distance we call the time-thickness. In subjective terms, the time-thickness appears to us as **the duration of the present instant**. As an analogy, it could be a fundamental, constant “*dt*” in time for the mathematicians.
3. The “particles” of matter that make up the physical world are due to holes, vacuoles, in the continuum. One dimension of these vacuoles is limited by the distance between the limiting hyperplanes. The strongly-

interacting “**particles**” **have a vacuole or an assemblage of vacuoles at their core.** Other particles are disturbances in the continuum, related to changes in the volume, shape, distribution, arrangements, and/or the relative motion of the vacuoles.

4. The time-thickness in our vicinity has been measured in units of length: it is the Compton wavelength of the electron, the **fundamental quantum.**
5. There is a universal time-thickness constant,  $t$  and it is related to the fine structure constant  $\alpha$ .

$$\alpha = \frac{1}{18 \cdot \pi \cdot t} \quad [6.1]$$

The fine structure constant is essentially a **time-thickness constant.**

6. The vacuole’s volume is related to **mass, energy, and temperature.**
7. The vacuole surface is related to **electric charge.**
8. Single vacuoles are stable when they have **even integral numbers of unit surfaces and unit volumes,** unless they can generate smaller vacuoles with lesser eccentricity.
9. Assemblages of vacuoles are stable when they are equi-eccentric and the **total number of unit surfaces and of unit volumes are even and**

**integral**, and cannot yield a combination or combinations of lesser eccentricity.

10. While vacuoles are confined within the time-thickness, their associated disturbances, fields, waves, or concentrations are not so confined. The electron, for example, extends outside the limits of the observable universe; **this is a fundamental fact that will have a big impact on the conclusion of this essay.**

Figure 6-1 attempts to show how the 3-D universe relates to the n-D UNIVERSE through a 4-D intermediate universe at the atomic level. It is, of course, **grossly out of scale**. It shows a unit vacuole with its unit surface, unit volume, and unit radius  $r = 1$ , the time-thickness  $2 \cdot t \cdot r$ , an electron, a positron, an electron-positron pair, the Bohr radius  $a_0 = 2 \cdot 3^2 \cdot \ell^2 \cdot r$ , and a Helium-4 vacuole with **four unit surfaces** and **eight unit volumes**.

# The Theory of Vacuoles and LENR

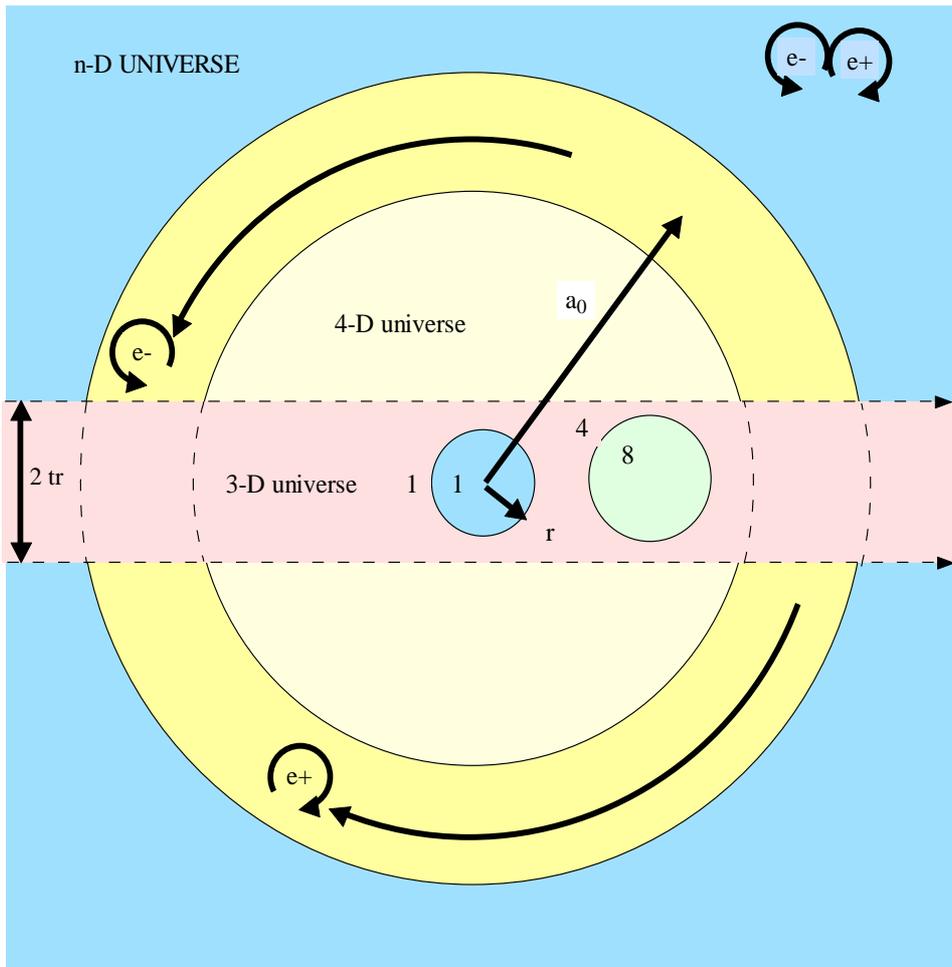


Figure 6-1. Relationship between 3-D, 4-D, and n-D universes

Figure 6-2 presents a simplified view at the cosmic level, and of course, is grossly out of scale. References to these figures occur in what follows. Of special note is the necessity of a **past** and **future**, plus and minus, yin-yang

property of the 3-D universe, distinguishing it from the 4-D universe and the n-D universe.

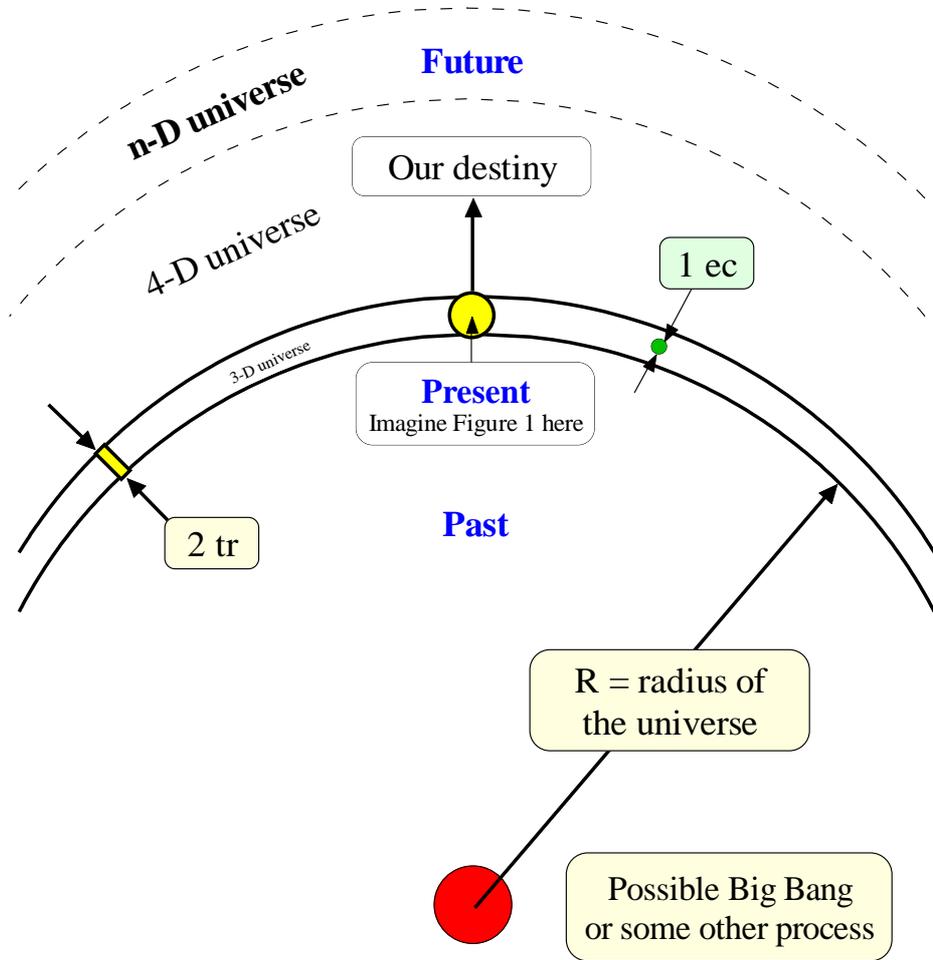


Figure 6-2. Simplified view at the cosmic level.

## 6.2 DIMENSIONS [D], DEFINITIONS, AND FORMULAS

$S[L^2] = x \cdot s =$  the surface area of a spheroid.

$V[L^3] = y \cdot v =$  the volume of a spheroid.

$x[1] =$  the number of unit surfaces of a spheroid.

$y[1] =$  the number of unit volumes in a spheroid.

The total number of unit surfaces and unit volumes in any stable vacuole or any stable assemblage of vacuoles **must be an even integer**. Unstable “particles” are centered on vacuoles with a non-integral sum of  $x \cdot s$  and/or  $y \cdot v$ , or simply  $S/V$ . For example a vacuole with two unit surfaces and two unit volumes is  $2/2$ .

## 6.3 PROPERTIES OF SPHEROIDS (VACUOLES)

In what follows let’s not confuse the electron charge  $e$  with what is going to be called the eccentricity  $e$  (*sorry for conflicting notations!*).

A prolate or oblate spheroid (vacuole) is completely defined by its surface area  $S$  and its volume  $V$ . In what follows, surface and volume are measured in terms

of a **unit sphere**, with surface  $s = 4\pi \cdot r^2$  and volume  $v = \frac{4\pi \cdot r^3}{3}$ . Any spheroid

has surface  $S = s \cdot x = 4\pi \cdot x \cdot r^2$  and volume  $V = v \cdot y = \frac{4\pi \cdot y \cdot r^3}{3}$ , where  $x$  is

the number of **unit surfaces**,  $y$  is the number of **unit volumes**, and  $r$  is the radius of the **unit reference sphere**.

In accordance with proposition 4 of the vacuole hypothesis,  $r$  is related to the Compton wavelength through a dimensionless constant,  $t$ , the time-thickness

constant  $l_{ec} = 2 \cdot t \cdot r$  , or  $r = \frac{l_{ec}}{2 \cdot t}$  .

Eccentricity of spheroids is given by  $e = \sqrt{1 - \frac{b^2}{a^2}}$  , where  $a$  and  $b$  are the major

and minor semi-axes, respectively. It is convenient to use the ratio  $(x^{3/2})/y$  as a measure of eccentricity (i.e., a function of eccentricity) instead of  $e$  to avoid awkward algebra. The hypothesis requires that all vacuoles in an assemblage

be equi-eccentric. Spheroids with equal values of  $\frac{x^{3/2}}{y}$  are equi-eccentric.

For prolate spheroids

$$\frac{x^{3/2}}{y} = \left[ \frac{\left( \frac{e}{1 - e^2} + \sin^{-1} e \right)}{\left\{ 2e(1 - e^2)^{1/6} \right\}} \right]^{3/2} \quad [6.2]$$

For oblate spheroids:

$$\frac{x^{\frac{3}{2}}}{y} = \left[ \frac{\left\{ 2e + (1 - e^2) \log_e \frac{1+e}{1-e} \right\}}{\left\{ 4e(1 - e^2)^{\frac{1}{3}} \right\}} \right]^{\frac{3}{2}} \quad [6.3]$$

If for prolate spheroids,  $e = e_p$ , and for oblate spheroids,  $e = e_0$ ,

$$\frac{x^{\frac{3}{2}}}{y} = \left[ \frac{\left( \frac{e_p}{1 - e_p^2} + \sin^{-1} e_p \right)}{\left\{ 2e_p(1 - e_p^2)^{\frac{1}{6}} \right\}} \right]^{\frac{3}{2}} = \left[ \frac{\left\{ 2e_0 + (1 - e_0^2) \log_e \frac{1+e_0}{1-e_0} \right\}}{\left\{ 4e_0(1 - e_0^2)^{\frac{1}{3}} \right\}} \right]^{\frac{3}{2}}$$

[6.4]

Any prolate or oblate spheroid is completely defined by any two of the following parameters:

- surface S,
- number of unit surfaces x,
- volume V,
- number of unit volumes y,
- eccentricity  $e_p$  or  $e_0$ ,
- major axis a,
- and minor axis b,

$$\triangleright \frac{x^{\frac{3}{2}}}{y}$$

The latter is a more convenient measure of eccentricity than  $e = \sqrt{1 - \frac{b^2}{a^2}}$ .

$$\text{Let } p[1] = \frac{x \cdot r^2}{a^2} \quad [6.5]$$

$$\text{Let } q[1] = \frac{y \cdot r^3}{a^3} \quad [6.6]$$

Then, for prolate spheroids,

$$2p = q + \left( \frac{\sqrt{q}}{\sqrt{1-q}} \right) \sin^{-1} \sqrt{1-q} \quad [6.7]$$

#### 6.4 THE ALPHA PARTICLE

An alpha vacuole (Helium-4 nucleus) can only be a 4/8 sphere, with eccentricity close to zero. We may note that the atomic mass of helium-4 is 4.0026 and that of hydrogen-1 is 1.0079. This reinforces the speculation that assemblages of spheroids must be equi-eccentric<sup>26,27</sup> for energetic compatibility. Helium-3, a 4/6

vacuole with  $\frac{x^{\frac{3}{2}}}{y} = 1.33$  has atomic mass 3.016. Clearly, there are relationships

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among stability, abundance, and eccentricity. Hydrogen-2, with an assemblage of vacuoles, has atomic mass 2.014 and  $\frac{x^{\frac{3}{2}}}{y} = 1.207$ . Evidently eccentricity is not the only factor influencing stability and abundance, but it seems certain that eccentricity plays a part. It remains a fact that the first estimate of the time-thickness constant, 2.42, was made on the speculation that all vacuoles in an assemblage must be equi-eccentric for energetic compatibility.

The vacuole hypothesis easily predicts that H-3, He-5, He-6 etc. cannot possibly be stable. Their nuclei must contain a “mixed bag” of vacuoles with very high eccentricity.

An important principle of the vacuole hypothesis is that a vacuole or an assemblage of vacuoles that can achieve an arrangement of lesser eccentricity without loss of surface or volume, will do so. Best examples are Lithium-5 and

Beryllium-8.  ${}^5\text{Li} = 6/10$  with  $\frac{x^{\frac{3}{2}}}{y} = 1.47$  decays to  $p+$  and  $0$ .  ${}^8\text{Be} = 8/16$  with

$\frac{x^{\frac{3}{2}}}{y} = 1.41$  decays to  $0 + 0$ .

## 6.5 THE LAMBDA PARTICLE

The lambda vacuole is evidently a prolate spheroid with major semi-axis

$$a = t \cdot r = 2.4233\dots$$

Calculation of the lambda volume proceeds as follows:

$$\text{From [6.5], } p = \frac{2}{t^2}$$

$$\text{From [6.7], } q = 0.16670$$

$$\text{From [6.6], } y = q \cdot t^3 = 2.372$$

The mass of the lambda particle is therefore  $2.372/2$  times the proton mass. The

$$\text{mass of lambda is then } m_p \times \frac{2.372}{2} = 1112.9 \text{ Mev.}$$

The published value is 1115.6.

## 6.6 THE XI PARTICLE

The proton and the lambda particle both correspond to prolate spheroids with two unit surfaces. In the early stages of the development of the vacuole hypothesis, it seemed obvious that spheres and oblate spheroids should be examined for possible correspondence with observed "particles." A spherical

vacuole with two unit surfaces has a volume  $y = x^{\frac{3}{2}} = 2^{\frac{3}{2}} = 2.828\dots$

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A corresponding “particle” should have a mass  $m_p \times \frac{2.828}{2} = 1326.7 \text{ Mev}$ .

Published values for  $\text{Xi}^0$  and  $\text{Xi}^-$  are 1314.9 and 1321.3.

### 6.7 THE ETA PARTICLE, $\eta$

The eta particle is described as a “light meson.” It corresponds to an oblate vacuole with two axes =  $2 \cdot t \cdot r$  and three unit surfaces. The volume of such a spheroid, calculated using [6.8], [6.9] and [6.10] is  $V = 1.17$  unit volumes. The mass of the eta “particle” is then  $m_p \times \frac{1.17}{2} = 549$ , **corresponding to the published value exactly**. An oblate spheroid with  $a = t \cdot r$  and  $S = 2$  is not possible.

### 6.8 THE UNIT SPHERE OR SPHEROID

The unit sphere, with unit radius  $r$ , unit surface  $s = 4\pi \cdot r^2$  and unit volume

$v = \frac{4\pi \cdot r^3}{3}$ , was designed as a “base of operations.” Its description in the

scheme outlined above is  $\frac{S}{V} = \frac{1}{1}$ . If it has a real-world “particle” counterpart, this

particle should have a mass of about half that of a proton. The K mesons, with a mass of 493-498 MeV, approximate this condition; on the  $p+ = 2$  scale, their

volume is about 1.05. To contain this volume, a surface  $x \cdot s = S = 1.03$  is necessary.

## 6.9 THE NEUTRON, $n^0$

The neutron is pictured as consisting of two 1/1 vacuoles, one positively and one negatively charged. The other neutral particle, lambda, is seen as a single vacuole with a negative and a positive charge. These two “particles” draw attention to an essential aspect of the vacuole hypothesis: **our universe is a 3-D “slice” of the n-D Universe, separating it into positive and negative adiabatic fluids.** This idea is mirrored by Honig<sup>28</sup> as follows: A model for vacuum space is described here which consists of the superposition of a negatively and a positively charge fluid, i.e., a fluid filled universe<sup>15</sup>. Vacuoles, in our universe, in this 3-D interface between + and – fluids, contain absolutely nothing. **Properties we associate with them are not properties of the vacuoles themselves, but properties of the continuum within which they exist;** again, the reader must meditate on this statement as it has huge implications to our necessary paradigm shift. A 2-D demonstration of these ideas is presented in figure 6-1.

## 6.10 THE n MESONS

The n mesons correspond almost exactly to a P-1 spheroid with  $a = t \cdot r$  and

$x \cdot s = \frac{2}{3}$ . Using [6.5], [6.6], and [6.7],  $V=0.29$ . This translates to a mass of

$$\frac{m_p \times 0.29}{2} = 136 \text{Mev.}$$
 Published values are 139.6 and 135.0 Mev.

## 6.11 NEUTRINOS

That neutrinos exist is unquestioned. Whether or not they can be described as “particles” is debatable, vacuoles probably. The neutrinos mass is zero, or is it? Their electric charge is zero. They can be produced during radioactive emissions when they emit energy without an attendant loss of mass. About 5% of the energy produced by atomic reactors is emitted as neutrinos. Neutrinos react with terrestrial matter, with an energy increase. They have been detected and “weighed” in a number of extraordinary experiments. Current interpretations of such experiments suggest that there may be several neutrino types, with masses varying from zero up to almost 15 Mev. A uniquely apt summary is given by Bahcall<sup>29</sup>.

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This leads to the speculation that neutrinos may be neutral combinations of electrons and positrons, the simplest of which is an electron-positron pair. If this approximates the truth, neutrinos exist “with only a tail” in our 3-D universe<sup>27</sup>. Their ability to proceed unimpeded through terrestrial matter, with only occasional interception, is thus easily explained by the picture of the electron generated by the vacuole hypothesis<sup>27</sup>.

**A basic tenet of the vacuole hypothesis is that a clear picture of our 3-D universe cannot emerge without taking into consideration the n-D Universe in which it is set. The “solar neutrino problem”<sup>29</sup> is not a 3-D problem; it is an n-D problem.**

### 6.12 SUMMARY OF A FEW IMPORTANT DEFINITIONS

Radius of a unit sphere =  $r$

Surface of a unit sphere =  $s = 4\pi \cdot r^2$  [6.8]

Volume of a unit sphere =  $V = \frac{4\pi \cdot r^3}{3}$  [6.9]

Major axis of any spheroid =  $2a$  [6.10]

Minor axis of any spheroid =  $2b$  [6.11]

## The Theory of Vacuoles and LENR

$$\text{Eccentricity of any spheroid} = e = \sqrt{1 - \left(\frac{b^2}{a^2}\right)} \quad [6.12]$$

$$\text{Surface of any prolate spheroid} = 2\pi \left[ b^2 + \frac{a \cdot b}{e} \cdot \sin^{-1} e \right] \quad [6.13]$$

$$\text{Surface of any oblate spheroid} = \pi \left[ 2a^2 + \left\{ \left( \frac{b^2}{e} \right) \ln \frac{1+e}{1-e} \right\} \right] \quad [6.14]$$

$$\text{Volume of any prolate spheroid} = \frac{4\pi \cdot a \cdot b^2}{3} \quad [6.15]$$

$$\text{Volume of any oblate spheroid} = \frac{4\pi \cdot a^2 \cdot b}{3} \quad [6.16]$$

$$\text{Surface of any spheroid} = S = x \cdot s = 4\pi \cdot x \cdot r^2 \quad [6.17]$$

$$\text{Volume of any spheroid} = V = y \cdot v = \frac{4\pi \cdot y \cdot r^3}{3} \quad [6.18]$$

$$x = \text{number of unit surfaces in any spheroid} \quad [6.19]$$

$$y = \text{number of unit volumes in any spheroid} \quad [6.20]$$

$$\text{For prolate spheroids, } V = \frac{4\pi \cdot y \cdot r^3}{3} = \frac{4\pi \cdot a \cdot b^2}{3} \quad [6.21]$$

Divide through by  $a^3$ :

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Find  $\frac{y \cdot r^3}{a^3} = \frac{b^2}{a^2}$  [6.22]

Let  $\frac{y \cdot r^3}{a^3} = \frac{b^2}{a^2} = q$  [6.23]

and  $\frac{x \cdot r^2}{a^2} = p$  [6.24]

$$S = x \cdot s = 4\pi \cdot x \cdot r^2 = 2\pi \left[ b^2 + \left( \frac{a \cdot b}{e} \right) \sin^{-1} e \right] \quad [6.25]$$

Divide through by  $a^2$  and substitute  $\sqrt{1-q}$  for  $e$ ,  $q$  for  $\frac{b^2}{a^2}$ , and  $p$  for  $\frac{x \cdot r^2}{a^2}$

We obtain:

$$2p = q + \left( \frac{\sqrt{q}}{\sqrt{1-q}} \right) \sin^{-1} \sqrt{1-q} \quad \text{which is equation [6.7].}$$

For oblate spheroids,  $V = \frac{4\pi \cdot y \cdot r^3}{3} = \frac{4\pi \cdot a^2 \cdot b}{3}$  [6.26]

Divide through by  $a^3$

and find  $\frac{y \cdot r^3}{a^3} = \frac{b}{a}$  [6.27]

Let

$$\frac{y \cdot r^3}{a^3} = \frac{b}{a} = \pi \quad [6.28]$$

and 
$$\frac{x \cdot r^2}{a^2} = m \quad [6.29]$$

let's rewrite [6.14] as follows:

$$S = x \cdot s = 4\pi \cdot x \cdot r^2 = 2\pi \cdot a^2 + \frac{\pi \cdot b^2}{e} \ln \frac{1+e}{1-e} \quad [6.30]$$

$$\frac{S}{a^2} = \frac{x \cdot s}{a^2} = \frac{4\pi \cdot x \cdot r^2}{a^2} = 2\pi + \frac{\pi \cdot b^2}{e \cdot a^2} \ln \frac{1+e}{1-e} \quad [6.31]$$

Using [6.28], [6.29] and [6.12], we obtain:

$$4m = 2 + \frac{\pi^2}{\sqrt{1-\pi^2}} \ln \frac{1+\sqrt{1-\pi^2}}{1-\sqrt{1-\pi^2}} \quad [6.32]$$

Tables of values, or their computer equivalent, enable calculation of the number  $y$  of unit volumes, which corresponds to the number  $x$  of unit surfaces in oblate and prolate spheroids. If the surface area and volume are known, the semi-axes  $a$  and  $b$  can be calculated. Calculation is much simplified in special cases where one or two axes are equal to the time thickness  $2t \cdot r$ .

### 6.13 NEUTRON, HYDROGEN, HELIUM, LITHIUM, BERYLLIUM

Figure 6-1 illustrates an atomic structure, as viewed by the vacuole hypothesis. At the center, a vacuole or assemblage of vacuoles is confined within the time-thickness ( $l_{ec} = 2 \cdot t \cdot r$ ) of the 3-D universe: surrounding the central vacuole(s), the substance of the nucleus and the electron cloud extends into the 4-D universe. The diagram is grossly out-of-scale.

Figure 6-3 shows vacuole configurations for the first four elements of the periodic table,  $S$  being the surface area and  $V$  the volume, with surface and volume measured in terms of a **unit sphere**.

If the reader intends to become more familiar with the following calculations, it would be beneficial to read references<sup>19</sup> and<sup>26</sup>.

The electron configurations of these four elements are:

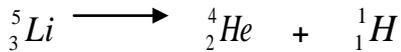
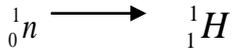
H		He		Li		Be	
s	s	s	s	s	s	s	s
1	-	2	-	2	1	2	2

## The Theory of Vacuoles and LENR

We may suppose that the corresponding vacuoles are described by:

$$\begin{array}{cccc}
 x = & 2 & 4 & 6 & 8 \\
 x = & 1 \times 2 & 2 \times 2 & (2+1) \times 2 & (2+2) \times 2 \\
 y = & 2 - 4 & 6 - 8 & 10 - 14 & 16 - 20
 \end{array}$$

The arrows in figure 6-3 show decay modes. For example:



These decays obey rule 8 (i.e., stability requires even integral numbers of unit surfaces and volumes, and an inability to form a combination of lesser eccentricity).

Table 6-1 lists the isotopes of these elements and corresponding vacuoles. Note that the instability of Li-5 and Be-8 is clearly explained by article 8 of the hypothesis.

# The Theory of Vacuoles and LENR

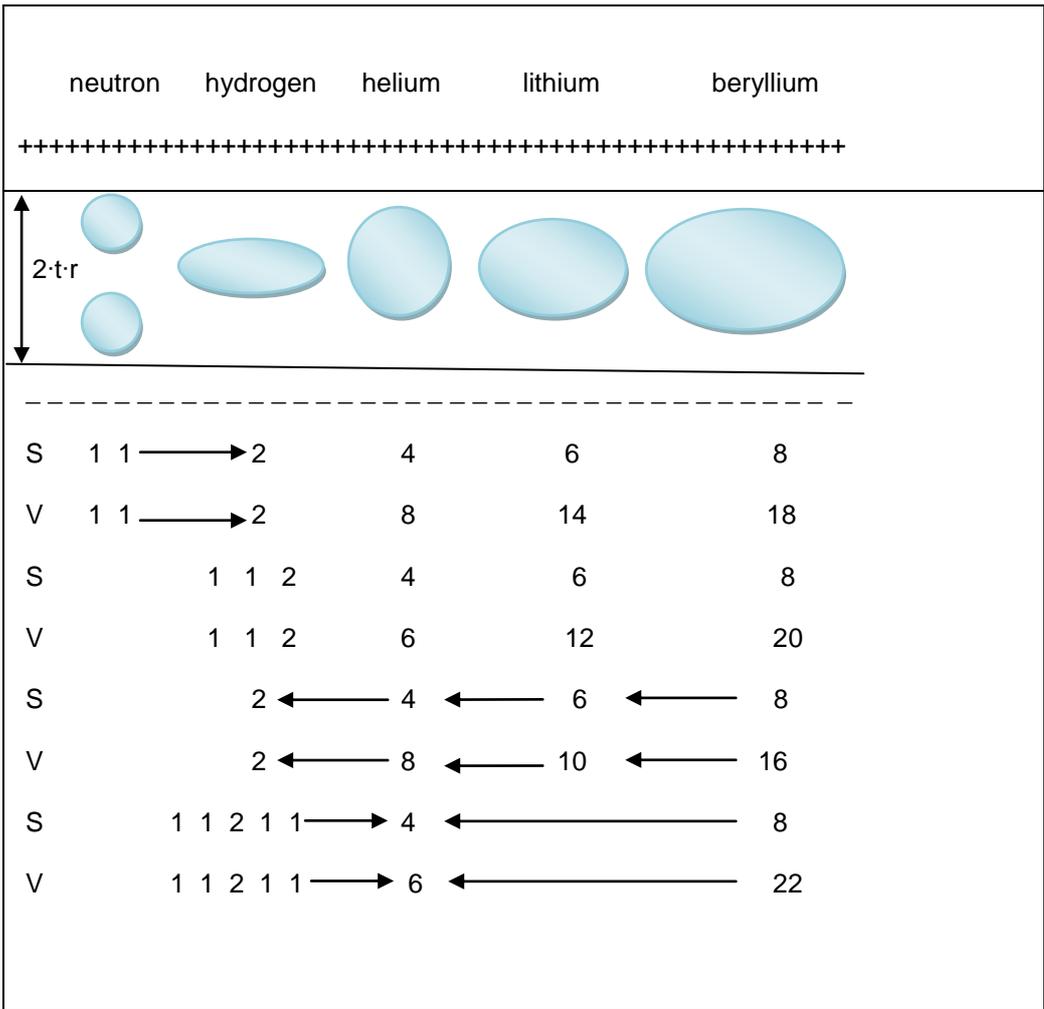


Figure 6-3. Vacuole configurations for the **first four elements** of the periodic table

## The Theory of Vacuoles and LENR

**Table 6-1- Stable vacuoles and corresponding “particles”**

Particle	Type*	x/y	a	b	MeV	$x^{1.5}/y$	Eccen- tricity	Note
unit	sphere	1/1	1	1	466.1	1	0	
eta	0 - 2	3/1.17	t	0.199	548.8	4.4	0.994	
p*	p - 0	2/2.013	3.0422	0.813	938.3	1.40	0.96	
lambda	p - 1	2/2.393	t	0.9938	1115.6	1.18	0.912	
Xi	sphere	2/2.828	$\sqrt{2}$	$\sqrt{2}$	1318.2	1	0	
<sup>3</sup> He	p - 0	4/6.025	4.025	1.220	2809.4	1.333	0.953	
<sup>4</sup> He	sphere	4/8.000	2	2	3728.4	1	0	
<sup>5</sup> Li	p - 0	6/10						1
<sup>6</sup> Li	p - 0	6/12.022	4.36	1.66	5603	1.22	0.92	
<sup>7</sup> Li	p - 0	6/14.022	3.25	2.03	6535	1.05	0.76	
<sup>8</sup> Be	p - 0	8/16						2
<sup>9</sup> Be	p - 0	8/18.103	5.22	1.86	8395	1.26	0.934	
<sup>10</sup> Be	p - 0	8/20.014	4.42	2.13	9327	1.13	0.87	
<sup>11</sup> Be	0 - 0	8/22						3
$\pi$	p - 1	(2/3)/0.292	t	0.346	139	1.86	0.99	4
$\pi$ - $\mu$	p - 1	(1/3)/0.074	t	0.175	35	2.60	0.99	5
Lambda (c)	p - 1	3/4.826	t	1.411	2249	1.08	0.813	6

### Notes:

\* p-1, prolate with one axis = 2t. p-0, prolate with no axis =2t. 0-2 oblate, two axes = 2tr.

1. <sup>5</sup>Li decays to (2/2) + (4/8).
2. <sup>8</sup>Be decays to (4/8) + (4/8).
3. <sup>11</sup>Be cannot contain a prolate spheroid.
4. Note fractional value for x, the number of surfaces.

5.  $\pi-\mu$  is a mass difference.

6. Note odd value for x. Particles  $B^+$ ,  $B^0$ , and  $B^{-0}$  approximate a 5/11 sphere.

This is the largest odd x possible.

Elements above beryllium have vacuole assemblages at their core, reflecting p, d, f electrons, and their “orbits”; in other words, p, d, and f electron shells enter the picture. It is reasonable to suppose that there may be some interactions between s shells, but not between or among s and p, d, and f shells. This may explain the existence of the various observed unstable isotopic isomers.

#### **6.14 FURTHER EXAMPLES**

The above concepts may be difficult to grasp at first. The following illustrated examples may clarify the subject for the struggling reader.

##### **Examples of hydrogen, helium, lithium, and beryllium**

The ratio  $S/V$  is illustrated in figure 6.4, followed by calculations for a neutron and two hydrogen isotopes. To be stable, smaller vacuoles must conform to the eccentricity of the largest.

## The Theory of Vacuoles and LENR

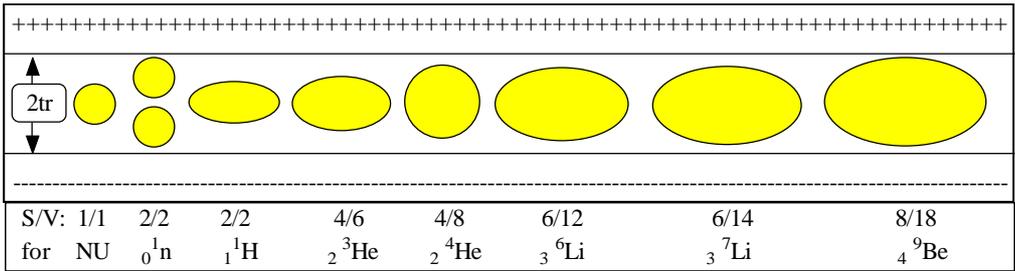


Figure 6.4 . Vacuole configuration for neutron, hydrogen,  
lithium, and beryllium

$${}_0^1n \text{ is a neutron, } \left[ +\frac{1}{1} - \frac{1}{1} \right]$$

$${}_1^2H \text{ is } \left[ \frac{2}{2.33} + \frac{1}{0.83} - \frac{1}{0.83} \right] \quad \text{with } \frac{x^{\frac{3}{2}}}{y} = 1.212$$

$${}_1^3H \text{ is } \left[ \frac{2}{1.24} + \frac{1}{0.44} - \frac{1}{0.44} + \frac{1}{0.44} - \frac{1}{0.44} \right] \quad \text{with } \frac{x^{\frac{3}{2}}}{y} = 2.276$$

### Example of Lutecium

Lutecium ( ${}_{71}Lu$ ) has the following electron configuration:

K	L	M	N	O	P
s	sp	sp d	sp d f	sp d	s

## The Theory of Vacuoles and LENR

2            2 6            2 6 10            2 6 10 14            2 6 1                    2

Total: 71 electrons.

The x-values of the corresponding assemblage of vacuoles are:

4 4 4 4 4 4    6 6 6 6 6 6 6 6    10 10 10 10    14 14 ... 2

Total: 142 vacuoles.

Which is equivalent to:

two vacuoles with  $x=14$ ,

four with  $x=10$ ,

eight with  $x=6$ ,

six with  $x=4$ ,

and one with  $x=2$ .

Corresponding y-values (vacuole volumes) are chosen so that the vacuoles are equi-eccentric and remain in the range determined by the constraint of the time-thickness (one axis must be less than or equal to  $2 \cdot t \cdot r$ ). This range is determined by the vacuoles with the number of unit surfaces ( $x$ ) of the largest vacuole ( $x = 14$ ). See figure 6.5.

The minimum y-values are:

$$y_{\text{minimum}} = 2^{\frac{3}{2}} + (x - 2)^{\frac{3}{2}}$$

This satisfies article 9 of the vacuole hypothesis.

For each spheroid:

$$y_{\max\ i\mu m} = \frac{x^{\frac{3}{2}}}{1.105} \quad \text{and}$$

$$y_{\min\ i\mu m} = \frac{x^{\frac{3}{2}}}{1.180}$$

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See summary in table 6-2.

**Table 6-2**

x	$y_{\text{minimum}}$	$y_{\text{maximum}}$	Sum $y_{\text{min}}$	Sum $y_{\text{max}}$
2 x 1	2.397	2.560	2.397	2.560
4 x 6	6.780	7.240	40.680	43.440
6 x 8	12.455	13.300	99.640	106.400
10 x 4	26.799	28.618	107.196	114.472
14 x 2	44.393	47.406	88.786	94.812
<b>2 ) 142</b>			<b>2 ) 338.699</b>	<b>2 ) 361.684</b>
<b>71</b>			<b>169.349</b>	<b>180.842</b>

Stable isotopes of Lutecium should be between mass numbers 169 and 180.

They are in fact:



For all stable element isotopes to fit this scheme, the time-thickness constant must have the value 2.42.... (Abbreviated from Spec. Sci. Tech. 4, NO. 3, 1981, p 288.)

## The Theory of Vacuoles and LENR

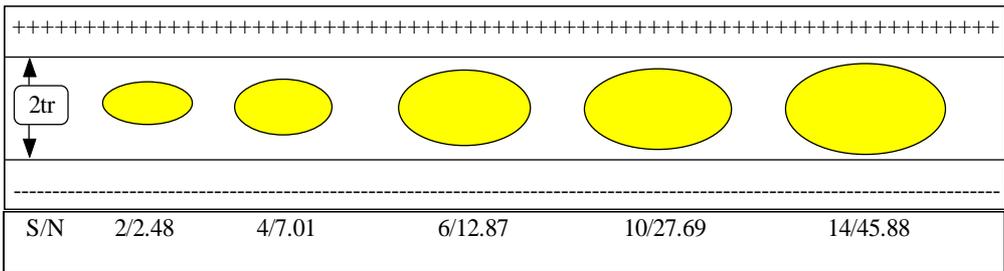


Figure 6.5. Vacuole configuration of Lutecium 175

Atomic Weight  ${}_{71}^{175}\text{Lu} =$

$$[(1 \times 2.48) + (6 \times 7.01) + (8 \times 12.87) + (4 \times 27.69) + (2 \times 45.88)] / 2$$

$$\frac{x^{\frac{3}{2}}}{y} = 1.1419$$

$$\frac{\sum x^{\frac{3}{2}}}{\sum y} = \frac{\left(1 \times 2^{\frac{3}{2}}\right) + \left(6 \times 4^{\frac{3}{2}}\right) + \left(8 \times 6^{\frac{3}{2}}\right) + \left(4 \times 10^{\frac{3}{2}}\right) + \left(2 \times 14^{\frac{3}{2}}\right)}{350} = \frac{399.66}{350} = 1.1419$$

It is important to note that the above calculations critically depend on the value assigned to the time-thickness constant  $t = 2.42$ . Only with this value do all the elements fit into the scheme outlined above. The value was adjusted until a fit was achieved.

## The Theory of Vacuoles and LENR

In the belief that a universal (perhaps also Universal) constant had been discovered, the other dimensionless constants were investigated, and means were sought to improve the accuracy of the estimate. The literature was searched for clues, and attention was drawn to a suggestion by Eddington that the fine structure constant may be exactly  $1/137$ . It was soon noted that:

$$2 \cdot 3^2 \cdot \pi \cdot 2.423 = 137.02$$

In 1995, the fine structure constant:

$$a = \frac{2 \cdot \pi \cdot e^2}{h \cdot c} = \frac{1}{137.035}$$

And the speculation that:

$$t = \frac{1}{2 \cdot 3^2 \cdot \pi \cdot a} = 2.4233$$

was promoted to an hypothesis to be investigated for validity. A further conjecture appeared. Since  $a$  could be reported as a function of 2, 3,  $\pi$ , and  $t$ , perhaps all the constants could be so reported. From article 5 of the vacuole hypothesis, the Compton electron wavelength is:

$$l_{ec} = \frac{h}{m \cdot c} = 2 \cdot t \cdot L$$

where  $L = r =$  the radius of a unit vacuole. A new unitary system begged for establishment, and this is the reason we spent a lot of time and effort on this

subject in this essay. In this new system,  $L = r = 1$ ; to transfer to the *SI* system,  $L$  becomes a conversion factor, new units (NU) to *SI* units, and the Compton wavelength can be written:

$$l_{ec} = \frac{h}{m \cdot c} = 2 \cdot t \cdot [L] = 2 \cdot t \cdot L$$

where  $[L]$  is merely a dimensional conversion factor NU of length to *SI* units (m).

### 6.15 COMPARING A STABLE ELEMENT WITH A NATURALLY RADIOACTIVE ELEMENT

It is interesting to compare the values  $\frac{x^3}{y}$  between  $^{197}\text{Au}$  and  $^{238}\text{U}$ .

The electronic configuration of stable  $^{197}\text{Au}$  is as follows:

K	L	M	N	O	P	Q
s	s p	s p d	s p d f	s p d	s p d	s
2	2 6	2 6 10	2 6 10 14	2 6 10	1	

There are

2 vacuoles with  $x = 14$ , 6 vacuoles with  $x = 10$ , 8 vacuoles with  $x = 6$ , 5 vacuoles with  $x = 4$  and 1 vacuole with  $x = 2$ .

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$$\frac{\sum x^{\frac{3}{2}}}{\sum y} = \frac{\left(5 \times 4^{\frac{3}{2}}\right) + \left(8 \times 6^{\frac{3}{2}}\right) + \left(6 \times 10^{\frac{3}{2}}\right) + \left(2 \times 14^{\frac{3}{2}}\right) + \left(1 \times 2^{\frac{3}{2}}\right)}{394} = \frac{454.9070}{394} = 1.1546$$

We may notice the obtained value is close to the preferred eccentricity  $\frac{x^{\frac{3}{2}}}{y}$  of about 1.14, which is further discussed in the next section.

However, for naturally unstable elements, such as  $^{238}\text{U}$ , for which the electronic configuration is as follows, this preferred eccentricity is no longer observed.

K	L	M	N	O	P	Q
s	s p	s p d	s p d f	s p d g	s p d	s
2	2 6	2 6 10	2 6 10 14	2 6 10 3	2 6 1	2

There are:

2 vacuoles with  $x=14$ , 6 vacuoles with  $x=10$ , 11 vacuoles with  $x=6$ , 7 vacuoles with  $x=4$ , and 1 vacuole with  $x=2$ .

$$\frac{\sum x^{\frac{3}{2}}}{\sum y} = \frac{\left(7 \times 4^{\frac{3}{2}}\right) + \left(11 \times 6^{\frac{3}{2}}\right) + \left(6 \times 10^{\frac{3}{2}}\right) + \left(2 \times 14^{\frac{3}{2}}\right) + \left(1 \times 2^{\frac{3}{2}}\right)}{476} = \frac{514.9978}{476} = 1.0819$$

Overall, the model fits very well with the facts: stable gold being closer to the ideal value of 1.14 than slightly radioactive uranium 238. It will be interesting to

see the distribution of these ratio values for all naturally occurring isotopes in chapter 10.

### 6.16 A FIRST ESTIMATE OF THE TIME THICKNESS CONSTANT

The first estimate of the time thickness constant was made by examining the periodic table of the elements, using the hypothesis that the 3-D universe has a thickness in time that limits one dimension of the vacuoles that must lie at the core of strongly-interacting “particles.”

Each stable isotope was examined, from hydrogen to bismuth, and an arrangement of vacuoles corresponding roughly to each electron configuration was prepared. The time-thickness was then “shrunk” until all elements just fit within its limits. The process was time-consuming, especially since calculators or computers did not exist when this was done between 1940 and 1945: it was a good way to kill time during war! It is best illustrated using the rare gases and the heaviest stable isotope,  $^{209}_{83}\text{Bi}$  :

**Table 6.3**

s	s	p	s	p	d	s	p	d	f	s	p	d	....	s	p
2	2	6	2	6	10	2	6	10	14	2	6	10		2	3

## The Theory of Vacuoles and LENR

The number of surfaces is twice the atomic number. We then have (Following the colors in table 6-3 may help the reader.):

$$S = (6 \times 4) + (9 \times 6) + (6 \times 10) + (2 \times 14) = 166$$

$$(x^{3/2})/y = (6 \times 8) + (9 \times 14.70) + (6 \times 31.32) + (2 \times 52.38) \quad \text{or}$$

$$(x^{3/2})/y = 48 + 132.27 + 189.74 + 104.77 = 474.78$$

For  ${}_{83}^{210}\text{Bi}$  8, 14.70, 31.62, 52.38 are divided by  $474.78/420$ , and

$V_{\max} = (6 \times 7.08) + (9 \times 13.00) + (6 \times 27.97) + (2 \times 46.34) = 420$ , in which all vacuoles are equi-eccentric.

Bismuth does not give a useful value for  $V_{\min}$ . It is included here to represent atoms with a full f/14 shell because the largest vacuole determines the maximum possible volume of each of the others.  $V_{\min}$  may be estimated from

$$y_{\min} = 2^{3/2} + (x - 2)^{3/2}.$$

With elements above beryllium, p, d, and f electron shells enter the picture. It is reasonable to suppose that there may be some interconnection between s shells, but not between or among s and p, d, and f shells. This may help

## The Theory of Vacuoles and LENR

explain the existence of various unstable isotopic isomers that have been observed.

To fit the model to the rest of the periodic table, it is necessary to suppose that elements above beryllium correspond to assemblages of spheroids, and that these assemblages are governed by rules similar to those governing electron configurations. Consider the rare gases (Ne, A, Kr, Xe, and Rn). The electron configuration for neon is

$$\begin{array}{ccc} s & s & p \\ 2 & 2 & 6 \end{array}$$

which leads to the following arrangement of vacuoles:

$$4 \quad 4 \quad 6 \quad 6 \quad \quad \quad 8 \quad 6 \quad 6$$

or

$$7.1 \quad 7.1 \quad 12.9 \quad 12.9 \quad \quad \quad 17.4 \quad 11.3 \quad 11.3$$

The volumes ( $y$  values) in each of these assemblages have been calculated to total 40, in such a way that the spheroids are equi-eccentric. The calculation proceeds as follows:

$$\frac{SUMx^{3/2}}{SUMy} = \frac{2(4^{3/2}) + 2(6^{3/2})}{40} = \frac{45.39}{40} = 1.13$$

y for x=4 is:  $\frac{4^{3/2}}{1.13} = 7.1$

y for x=6 is:  $\frac{6^{3/2}}{1.13} = 12.9$

$$(2 \times 7.1) + (2 \times 12.9) = (1 \times 17.4) + (2 \times 11.3) = 40$$

Note that the maximum y for x=6 is 14.6. No spheroid with x greater than 16 can be stable. Minimum values are given (for x greater than 4) by:

$$y_{\min imum} = 2^{\frac{3}{2}} + (x - 2)^{\frac{3}{2}}$$

Minimum values occur, as with Li-5 and Be-8, when a vacuole can convert to a combination with less eccentricity.

**It is very important to note that calculations made for the rare gases show**

**a preferred eccentricity  $\frac{x^{\frac{3}{2}}}{y}$  of about 1.14. Just in passing, this is a**

**coincidence showing we are on the right track. Atomic weights for all the elements above carbon can be estimated using this "coincidence."**

## The Theory of Vacuoles and LENR

For example, lutecium has two vacuoles with  $x=14$ , four with  $x=10$ , eight with  $x=6$ , six with  $x=4$ , and one with  $x=2$ .

$$\text{Then } \sum \frac{x^{\frac{3}{2}}}{y} = \left(2 \times 14^{\frac{3}{2}}\right) + \left(4 \times 10^{\frac{3}{2}}\right) + \left(8 \times 6^{\frac{3}{2}}\right) + \left(6 \times 4^{\frac{3}{2}}\right) + \left(1 \times 2^{\frac{3}{2}}\right) = 399.9$$

Dividing by 2(1.14) gives an estimated atomic weight for lutecium of 175.3. The actual atomic weight is 175.0.

### 6.17 THE VACUOLE THEORY'S NEW VIEW OF THE BOHR HYDROGEN ATOM

The Theory of Vacuoles leads to an enlarged view of Bohr's model of the

hydrogen atom. **A consequence is an explanation of the ratio  $\frac{m_p}{m_e}$ , the**

**mass ratio of the proton and the electron.** The vacuole or group of vacuoles that generates the proton is pictured as being confined by the time thickness

$2 \cdot t \cdot r = 1_{ec}$  of the 3-dimensional universe. The substance of the proton (i.e., its

"field") extends outside the 3-dimensional universe to an "s" electron

surrounding it at a distance, which is the Bohr radius. A proton vacuole has two

unit surfaces and two unit volumes. We suppose that the electron is similarly

bivalent. The electron is contained between two concentric 4-dimensional spheres of radius  $(a_0 + x \cdot t \cdot r)$  and  $a_0 - y \cdot t \cdot r$ , where  $x + y = 2$  and  $a_0 = 2 \cdot 3^2 \cdot t^2 \cdot r$ , the Bohr radius;  $x$  and  $y$  here are unrelated to vacuole surface and volume.

The volume between these concentric 4-dimensional spheres<sup>30,31,32</sup> is:

$$V_0 = \pi^2 \left[ \frac{(a_0 + x \cdot t \cdot r)^4 - (a_0 - y \cdot t \cdot r)^4}{2} \right] \quad [6.33]$$

The 4-dimensional intersection of these spheres with the confining planes of the 3-dimensional universe generates a 4-dimensional volume:

$$V_t = \left[ \pi \cdot (t \cdot r)^2 \cdot (2 \cdot t \cdot r) \cdot (2 \cdot \pi \cdot a_0) \right] = 2^2 \cdot \pi^2 \cdot t^3 \cdot a_0 \cdot r^3 \quad [6.34]$$

The ratio  $\frac{V_0}{V_t} = \frac{m_p}{m_e} = 1836.15$  when  $x = 0.47769$ ,  $y = 1.52231$ . This is

illustrated in figures 6-1, 6-2, and 6-8. Figure 6-9 shows  $V_0/V_t$  when  $x = 0, 1, 2$ .

### Important derivation

$$\frac{V_0}{V_t} = \frac{\pi^2 \frac{(a_0 + xtr)^4 - (a_0 - ytr)^4}{2}}{2^2 \cdot \pi^2 \cdot t^3 \cdot a_0 \cdot r^3} \quad [6.35]$$

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$$a_0 = 2 \cdot 3^2 \cdot t^2 \cdot r \quad [6.36]$$

$$r = 1 \quad [6.37]$$

$$t = 2.42332945 \quad [6.38]$$

$$\text{Let } T = 2 \cdot 3^2 \cdot t \quad [6.39]$$

$$\text{Then } a_0 = T \cdot t \quad [6.40]$$

$$\frac{V_0}{V_t} = \frac{t^4(T+x) - t^4(T-x)}{2^3 \cdot T \cdot t^4} \quad [6.41]$$

$$\frac{V_0}{V_t} = \frac{(T+x)^4 - (T-x)^4}{8T} = \frac{T^4 + 4T^3x + 6T^2x^2 + 4Tx^3 + x^4 - T^4 + 4T^3y - 6T^2y^2 + 4Ty^3 - y^4}{8T}$$

$$\frac{V_0}{V_t} = \frac{4T^3(x+y) + 6T^2(x^2 - y^2) + 4T(x^3 + y^3) + (x^4 - y^4)}{8T} \quad [6.42]$$

$$x + y = 2 \quad [6.43]$$

$$x^2 - y^2 = 4(x-1) \quad [6.44]$$

$$x^3 + y^3 = 2(3x^2 - 6x + 4) \quad [6.45]$$

$$x^4 - y^4 = 8(x^3 - 3x^2 + 4x - 2) \quad [6.46]$$

$$\frac{V_0}{V_t} = T^2 + 3T(x-1) + (3x^2 - 6x + 4) + (x^3 - 3x^2 + 4x - 2)/T$$

[6.47]

$$\frac{V_0}{V_t} = \frac{x^3}{T} + \left(3 - \frac{3}{T}\right)x^2 + \left(3T - 6 + \frac{4}{T}\right)x + T^2 - 3T + 4 - \frac{2}{T}$$

[6.48]

If  $\frac{V_0}{V_t} = \frac{m_p}{m_e} = 1836.1527$  (1986 value) [6.49]

Then  $\frac{V_0}{V_t} - 1836.1527 = 0$  [6.50]

Which is equivalent to:

$$0.0229253004 \cdot x^3 + 2.9312241 \cdot x^2 + 124.9514915 \cdot x - 60.360038 = 0$$

Whence  $x = 0.47769$  and  $y = 1.52231$ , which can be conveniently used in a Poisson model as illustrated in figure 6.8.

## 6.18 THE SCHROEDINGER CAT CONNECTION

The “s” electron should be seen as dynamically occupying half the volume of the 4-dimensional “shell” between the 4-dimensional spheres. In figure 6-7, our 3-dimensional Universe is seen as a 3-dimensional slice of another n-dimensional

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Universe of thickness  $2tr$ . The “s” electron occupies the space between two concentric 4-dimensional spheres. **Only 1/1836 of it is visible within our Universe and registers on our mass-measuring devices.** Also, it appears to us in two places at the same time,  $2a_0$  apart. The significance of this prompts the cartoon of Schrodinger’s cat applied to figure 6-1 and as illustrated in figure 6-6.

This poor kitty cat’s destiny begs for its consideration in any speculation on a double-slit experiment and the wave-particle duality of material, so-called “particles.”

The electron pictured in the sketches is, of course, a spherical ground-state electron. The addition of energy leads to higher states and, eventually, to its separation from the proton. Honig<sup>9,28</sup> has described a “fluid model for vacuum space and the electron” that proposes a “two-fluid model with a negatively and a positively charged fluid, giving 3-dimensional space the qualities of a neutral plasma.” As noted in figures 6-1, 6-2, and 6-6, the vacuole hypothesis also shows a two-fluid character, which are labeled as + and -. The +/- nature of the 3-dimensional universe is essential to the hypothesis.

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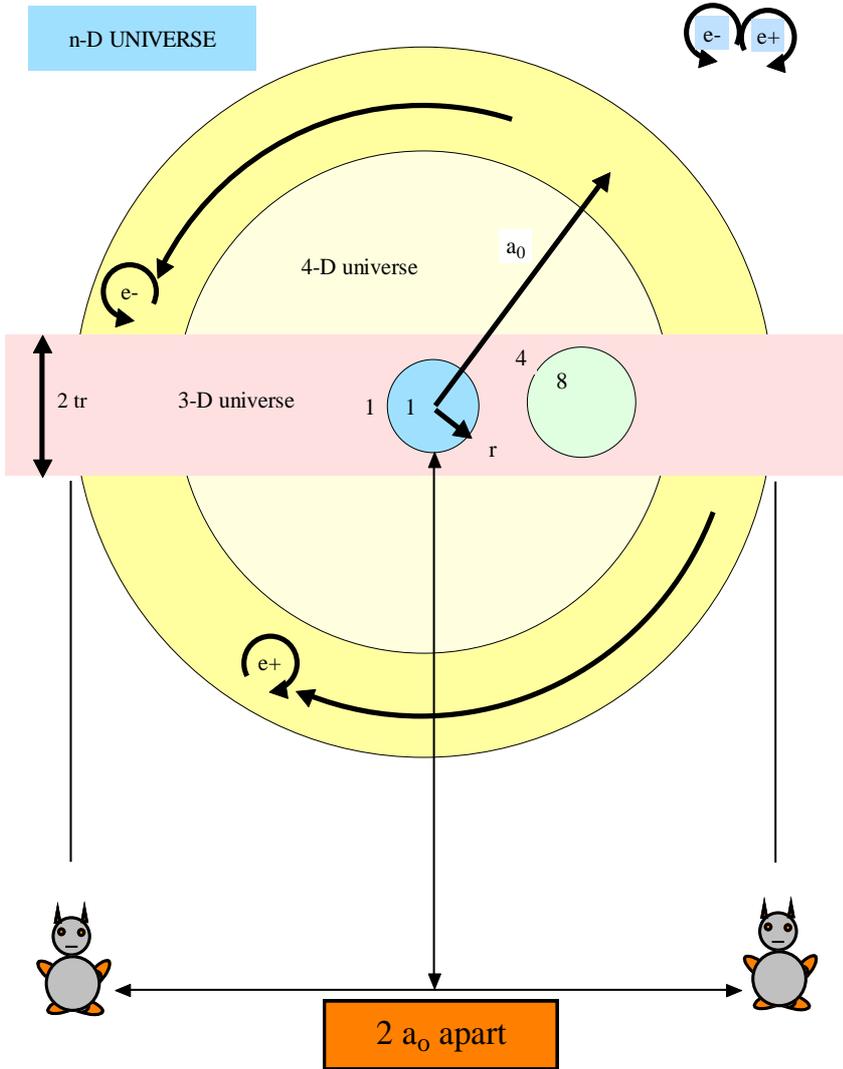


Figure 6-6. A new view of the Bohr hydrogen atom.

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Figures 6-2 and 6-8 are “blow-ups” from portions of figure 6-1. They indicate how the electron may be distributed within its shell. The distribution is tentatively shown as Poisson; how it appears inside our 3-dimensional universe has been described elsewhere. Honig’s well-illustrated perceptions fall nicely into the Poisson model.

The separation of an electron from an atom does not change the electron’s character much, at least, as far as we know. **It remains a creature with only a “tail” in our 3-dimensional universe.** One may think of the “electron in a box” that permitted accurate measurement of the “g-factor,” or a power line carrying electrical energy. However big the box or thick the cable is, its dimension in time remains close to  $1_{ec} = 2.42 \times 10^{-10}$  *centimeters*. **Electric current is indeed carried outside its conductor and, in my view, outside our 3-dimensional universe.**

Figure 6-9 shows the expansion of the Poisson model.

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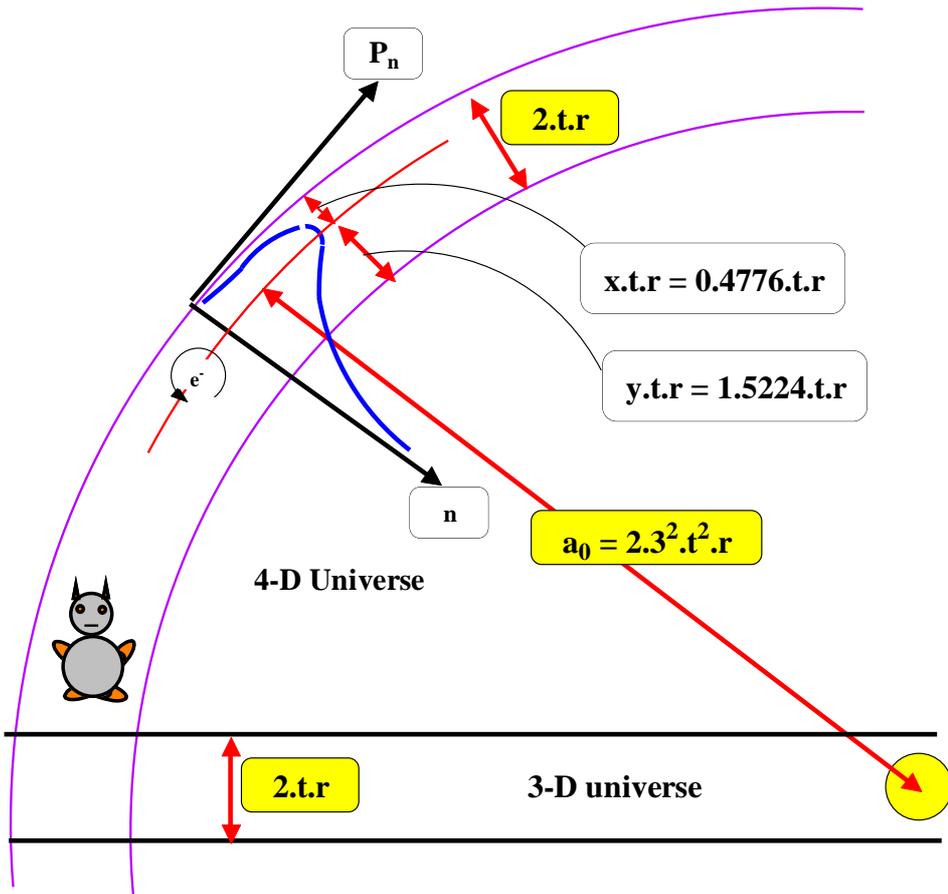


Figure 6-7. An expansion of a portion of figures 6-1 and 6-5, in which the distribution of the electron within its "shell" and its position vis-à-vis the Bohr radius is illustrated.

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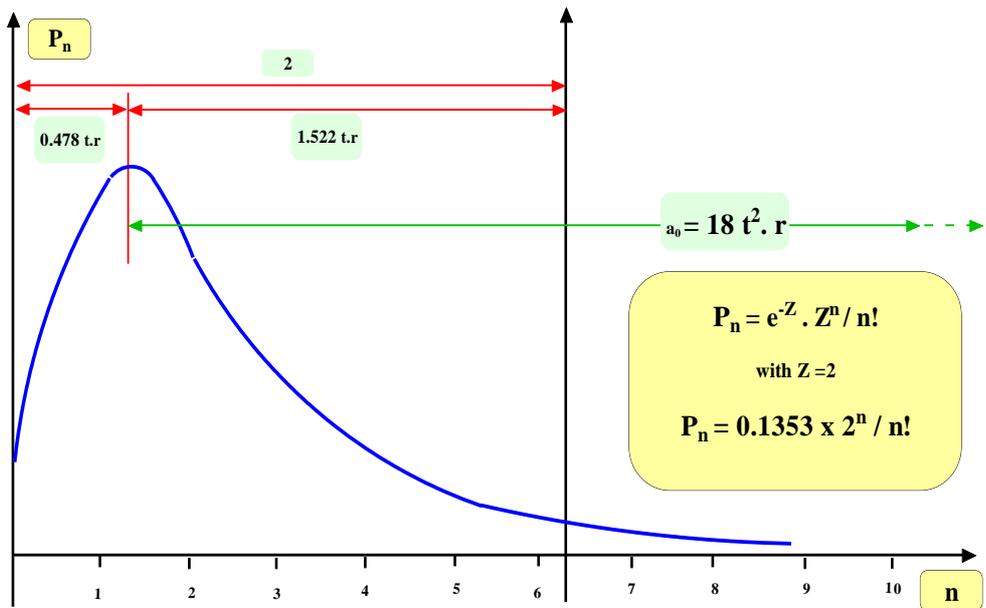


Figure 6-8. Poisson distribution of the electron within its shell. The value of  $Z$  is 2 in the distribution's modeling.

In figure 6-8, a gamma function can be used to turn the Poisson discrete distribution into a continuous probability distribution. It is important to notice that there is a maximum probability for the presence of the electron vacuole for a radius  $a_0 = 2 \cdot 3^2 \cdot t^2 \cdot r$ . It should be clearly understood that the probability domain of the electron around the proton is actually a shell or thin edge around a sphere. It seems likely that a similar distribution emanating from the proton may be discovered.

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Figure 6-7 illustrates the location of the electron shell in orbit around the proton.

It is important to notice that only with the electron Poisson/gamma distribution

shown in figure 6-6 does the ratio  $\frac{V_0}{V_t} = \frac{m_p}{m_e} = 1836.15$  when  $x = 0.47769$ .

$$\text{If } x = 2, \frac{V_0}{V_t} = 2037.60$$

$$\text{If } x = 1, \frac{V_0}{V_t} = 1903.70$$

$$\text{If } x = 0, \frac{V_0}{V_t} = 1775.79$$

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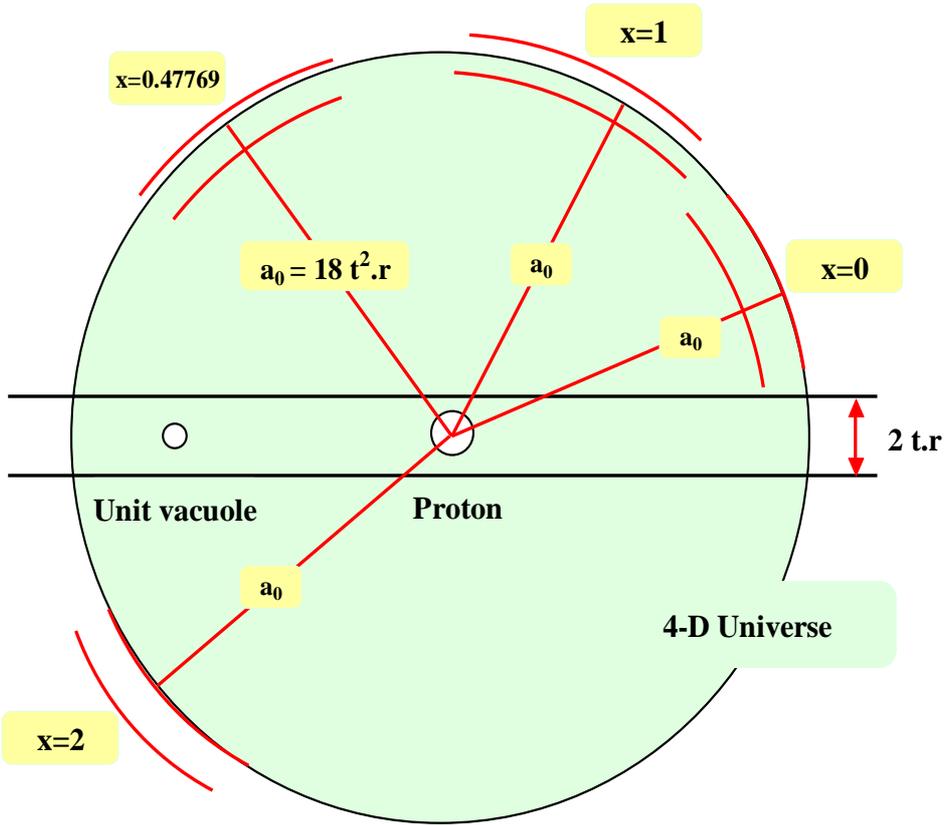


Figure 6-9. Location of the electron shell relative to the Bohr radius.

## CHAPTER 7

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### THE ATOM STRUCTURE IMPLICATIONS

This chapter is so important that I don't really know where and how to start. If Oliver Ingamells was alive, he would smile at my quandary and shift sideways from one leg to another, as he always did with a silent smile when something of great significance and food for thought would be said soon.

#### 7.1 INTRODUCTION

For most scientists around the world today, and especially physicists, using David Parrish's words (2006)<sup>33</sup>, **“the theory of what the Universe is would be complete only if it unifies the observer with the observed, subtle matter with dense matter, and these with their source.”** The vacuole hypothesis provides the tools to dramatically reach that goal.

Since almost 6000 BC, we have looked at ourselves as though we were cursed. As a result, our lives, more or less, looked like they were meaningless in possibility and scope; we were just swimming in a sea of humble insignificance,

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which is certainly not an invitation to accomplish great achievements, except, of course, for the few controlling everything we do. Using the words of David Parrish again, it was our view that “we were trapped in the hell of an observed material world of chaos and unremitting disintegration.” Now, it does not have to be that way. Now, there is a profound meaning in what we think, especially how we think, do, and believe **“where awareness recognizes that its content is the essence of uninterrupted oneness with all that is.”** Please, take your time to carefully read and digest every word of this last quote.

There is not a world (i.e., universe) out there that we can see and study the way we wanted to for centuries and, amazingly, we are getting good at it; but, everything we see is an illusion, a virtual image of the shell/edge of vacuoles. We have learned that vacuole’s shells are all waves and high energy level vibrations, which are floating in the fainter medium, *Ether*, which itself is made of waves and levels of energy within an extremely wide-spread spectrum. It is the only thing there is; it is us; and matter, as we model it, does not exist; unless you take a deep breath, close your eyes, and think for a minute what you could do if you were a subtle part of universal entanglement. But, this is the catch, we don’t

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know how to use universal entanglement as we were never trained to search and look for such a thing.

If this is not extraordinarily exciting to you my friends, then nothing at all will ever be; go back to the beginning of the essay and start all over again, because you have not understood anything. **It does not have to change what we believe in; it changes the way we look at what we believe in: the subtlety has a profound reach.** Indeed, if the material universe, as we know it, does not exist, then we may ask: what does exist? The only thing that exists is that background "stuff," which we call electromagnetic waves, universal consciousness, Supreme Being, All-Mighty, or whatever you want to call it, the nature of which still escapes our comprehension. In other words, as the distinguished British astronomer Sir James Jeans intuitively put it in 1983, and I truly think the quote has a long reach: **"The stream of knowledge is heading toward a non-mechanical reality; the universe has begun to look more like a great thought than a great machine."** Indeed, our thoughts are all electromagnetic waves and, thanks to universal entanglement, our thoughts, **and all of them**, go far beyond everything we ever imagined; but, how far can they go? **Then, we may have far more responsibility in our daily acts than we ever believed; it is humbling and also scary, but it carries power in its reach and, this**

**alone, is beautiful.** No wonder we have to learn to live peacefully, with good ethics! That also is an exciting subject, but a matter for another book, in another context.

Then, instead of being cursed with “nothingness,” as we think we are, which leads to negative thoughts, deceit, jealousy, depression, and loneliness, we can thrive, take the thought, work on it, look at its infinite beauty, and I will bet anything it will only lead to joy, pride, good will, and love, all positive thoughts. We are not cursed. We were never cursed. We were only prisoners of paradigms imposed on us at the birth of civilization, and they were contrived by humans and made for political power and control alone. For convenience, we were taught what to think; for world leaders it was not a good thing to teach us how to think; and this still goes on today... especially today!

Now, what could be the ideal tool to go forward for ourselves: meditation! We must expand on this, assuming we already know what the truth is, so we must constantly remain positive. Remember, **we are now the creative participant in what the universe should be and no longer the passive observer of what the universe is.** Let’s rephrase this because it is so critically important. **Each of us is inhabited by what we call consciousness. But, with the Theory of**

**Vacuoles, such consciousness is no longer in you or me or every one of us; it is one and everywhere at once. Therefore, plain Cartesian logic would easily deduce consciousness is an attribute of the only thing there is, *Ether*; there is no other way possible.** The 17<sup>th</sup> Century mathematician and philosopher Rene Descartes once said, “I think therefore I am.” This classical, powerful statement now becomes “I am one with the Universe, therefore I think.” In other words, you, animals, minerals, etc. do think. The paradigm created by our five senses is a limiting factor of incredible proportion; it limits or, I should say, eradicates the way we should think.

Quantum Theory told us that the world around us is not what we think it is. It is rather disturbing that such a breakthrough, which has been going on for more than 100 years now, and has created enormous scientific excitement is still incapable of changing our old, primitive ways in philosophy and religion. We are simply, quietly sleeping in massive psychological denial because we are afraid of shifting paradigms unless absolutely necessary; but, what kind of event will it take to awaken us? It is my view that, in philosophy today, the Ratio Occidentalis is no more evolved than a monkey playing with a typewriter; we have a long way to go.

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It is stunning how difficult it is for the “Establishment” to change its paradigm. Let’s take the example of the Fermi paradox: if millions of civilizations are far more advanced than we are, why have they not contacted us through radio waves or some kind of laser communication? Our naivety makes us pathetic. In section 1.1, the first great giveaway, scientists have already demonstrated in several laboratories around the world that photons can communicate 10,000 times faster than the speed of light, which clearly tells us universal entanglement is real. We invented radio communications only 200 years ago; how is it conceivable that an advanced civilization ahead of us by billions of years would still be using radio, or lasers, to communicate? Such advanced civilizations will use universal entanglement to communicate instantly, no matter where they are or how far they are. They don’t need to communicate with us using primitive technologies; they don’t need to visit us to see us. They observe us when and where they please through universal entanglement. As we don’t know how to use universal entanglement yet, we have no idea that they have been studying us for many thousands of years, and I will surmise they are not impressed, but this is another subject.

## 7.2 FORBIDDEN SPECULATIONS

Lightman and Gingerich<sup>34</sup> and R.D. Wright<sup>35</sup>, as well as several others, have drawn attention to the difficulties faced by speculators whose ideas clash with established Science, that is, with the "Standard Model." Only occasionally does a speculation grow into a successful hypothesis and even less often does it defy the "Establishment" and makes its way into the mainstream. Yet the major advances in human understanding have almost always come from what was first perceived as absurd or heretical. Even successful speculators may never reap the fruits of their success. Their rewards are likely to be persecution, excommunication, hate, or gentle ostracism, such as was the case for Galileo, Pasteur, de Broglie, and Darwin.

A difficulty in formulating a truly new perception is the inevitable lack of vocabulary; the words and mathematics may not exist, or if they do, are not familiar to those who must pass judgment. A further problem is the "Establishment's" stubbornly conservative reluctance to consider major changes in the current Standard Model. A speculation, however sound and well-formulated, that promises to short circuit cherished ways of thought and ongoing research is a potential disaster, financially and intellectually, and is not welcome!

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Lightman and Gingerich cite examples of past and present “anomalies” (their word), “The Flatness problem,” “The Peri-gee-Opposition Problem,” “The Continental-fit Problem,” “The Adaptation-of-Organism Problem,” and “The Equality of Inertial and Gravitational Mass.” None of these are a reason to upset any existing applecart; it is safe to mention and discuss them.

There are problems (i.e., anomalies) in these days—I state them bluntly—“The Problem of God” or “The problem of Mass.” These are today’s “forbidden” problems. A few established scientists have dared, rather obliquely, to acknowledge their existence; for examples see Roger Penrose<sup>36</sup>, H. Zemanek<sup>37</sup>, A. Einstein<sup>38</sup>, and others. It seems that Science cannot move closer to the understanding that I suppose is its legitimate goal, to the Truth, without a satisfactory resolution of these problems.

Another example is electromagnetism. We have found how to use it, but we still have no real understanding of what it is. Don’t you see? Right there is a similarity for what is happening with Cold Fusion or, I should say Low-Energy Nuclear Reactions. Perhaps understanding may come only after the solution of one or another of the “forbidden” problems? We did not understand the motion of the planets until the speculations of Aristotle and successors up through

Galileo were accepted. Doctors were helpless against bacterial infections before Pasteur's heresies became truths. On a melancholy note, the Bomb would not exist without development of Einstein's speculation, which itself relied on the strange ideas of many other speculators.

### **7.3 IMPLICATIONS FROM THE THEORY OF VACUOLES**

The Theory of Vacuoles may offer elegant explanations to many stubbornly persistent mysteries; let's review a few of them.

#### **The "stuff" making up the Universe**

The notion of space, as we perceive it and as originally used in physics is relative to the existence of "rigid bodies" having a certain position at any given time. However, that view may not be how we should look at it, and quantum mechanics has been good at challenging that very old perception created by our very limited senses. Let's take a deep breath, close our eyes, and imagine for a minute that the only thing there is, is the "stuff," *Ether*, or *Light* in a broad sense, or whatever you please to call it. It is what makes up everything we can see, and being fully aware that that "stuff" is beyond our 3-D field of observation (i.e., five senses), since such an observation would necessarily involve particles (e.g., electrons, protons, neutrons, quarks, gluons, higgs, etc...) as we know them.

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Some readers may still have a problem with the concept of a universal background “stuff” that under no circumstances, can be observed with our present technology. If you are among those readers, please go back to chapter 1 and reread the vision and revisit the great giveaways, as they are indeed some of the implications.

### **Waves and only waves**

This “stuff” is, according to the Theory of Vacuoles, activated by many kinds of waves: the ones we cannot observe with any contemporary experiments, the ones that are quite obvious to physicists in their experiments today, and the ones concentrated at the shell/edge of vacuoles. The latter being like closed strings that vibrate within the narrow domain of a sphere, oblate, and prolate spheroids, inside of which there is absolutely nothing at all; It is that, the shell of waves, that we see and perceive as matter. Matter is, therefore, only our perception of a “rigid body” that, in reality, is the composite image of something very, very different; no wonder we fear death!

### **Photon and vacuoles**

We may rightly wonder if the “stuff” and the photon, which is our creation, are the very same thing. The giveaway is the foundation of quantum mechanics,

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which explains why a photon can behave, on one hand, like a wave, but on the other, like a particle. The fundamental difference between these two concepts appears, at first glance, like a contradiction, but is really about the scale at which the problem is analyzed. It is fair to say that, as far as the photon is concerned, we have a serious problem of scale, and we have indeed the same problem with neutrinos.

So, we build those wonderful models about quanta of light, quanta of energy, quanta of matter and quanta of electricity. In a way, there are tiny packages at the very limits of what we can explain, and they indeed appear to have an existence of their own. So, is it conceivable that the photon is the smallest vacuole making up the Universe? If so, then the photon must have an apparent mass, though it is so small that we have no way of measuring it today; furthermore, it all depends on how many dimensions exist in the universe we are talking about. It starts to look very much like the dog chasing its own tail.

### **The fundamental “stuff” and mass**

As mortals, we have an obsession with mass; everything must have a mass.

The energy of a photon is  $E_{\text{photon}} = h \cdot \nu$ . The mass of a photon when it does not

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move is zero, but there is hardly such a thing. But,  $E_{\text{photon}} = m \cdot c^2$ , therefore, the mass of a moving photon is  $m = \frac{v \cdot h}{c^2}$ . But, things get complicated considering that light is capable of being polarized; as a consequence, people thought that *Ether* must have the same characteristics as a solid body rather than a fluid. The necessity for a stationary *Ether* was discovered from the very important Fizeau experiment. The following quote is important:

“This dualism (pro and con of the existence of an *Ether*) still confronts us in an unending form in the theory of Hertz, where matter appears not only as the bearer of velocities, kinetic energy, and mechanical pressures, but also as the bearer of electromagnetic fields. Since such fields also occur in vacuo (i.e., in free *Ether*), the *Ether* also appears as bearer of electromagnetic fields. The *Ether* appears indistinguishable in its functions from ordinary matter. Within matter it takes part in the motion of matter and in empty space it has a velocity everywhere; so that the *Ether* definitely has an assigned velocity throughout the whole of space.”<sup>39</sup>

So, as it is all a matter of scale, many experiments today would suggest the presence of a steady *Ether* that does not move at all. It may be different on a totally different scale, and the *Ether* “stuff” may indeed have a very faint mass of its own, or it may possess a mass that remains to be defined outside our visible

universe. In other words, the scientific literature longs for the logical presence of *Ether*, but a different one unexplored yet. And, we dare say *Ether* is the only thing there is, therefore, let's roll up our sleeves and start investigating it in a far more serious way than what has been done so far. In other words, **all things we know (e.g., matter, bodies, particles, photons, etc...) are connected one way or another through universal entanglement.** *Ether* has an amazing capability to create perceptible images... but now we are entering the philosophical and religious domain, which I will not dare to explore in this essay, at least not too much.

### **Time (T) and Mass (M) are Fickle!**

Among the questions that have been asked, but have never been answered to the satisfaction of all, is one, which may seem of little consequence, and hardly worth consideration was approached by Huntley<sup>40</sup>. He drew on the works of Fourier, Bridgman, and several others who perceived the subject's import. Huntley expresses this question more clearly than some others:

**“A careful reading of the relevant literature suggests that the point of view of some physicists has been based on an assumption that cannot be justified, namely, that corresponding to each physical quantity there is a unique dimensional formula that can be written in one way only.”**

Huntley answers this implied question by rejecting the possibility of "Absolute Dimensions," arguing that dimensional formulas are based on definitions and methods of measurement, the selection of which is, within limits, arbitrary. In his summary on the subject, he distinguishes among dynamic, thermal, and electromagnetic quantities, and draws attention to the imperfect, sometimes confused, relationship currently existing between and among these three categories.

The vacuole hypothesis introduces the possibility that a "fundamental" system of dimensions may exist. It attempts to formulate such a system. **A key to this effort is the recognition that mass and time are not reliable dimensional parameters and that they can and should be replaced because they are clearly not always mutually independent.**

Mass is related to time through the relation  $[M] = \left[ \frac{L}{T} \right]$ . Energy =  $mc^2$ .

Fractional exponents in electromagnetic dimensional statements derive from the observation that  $k \cdot u = \frac{1}{c^2}$ . In dynamic units, temperature is the square of a velocity; in thermal units, it is assigned its own symbol (in this work,  $K$ ).

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Temperature may be regarded as the intensity factor of isothermally unavailable energy; then, should not it be related to electric potential difference, the intensity factor of electric energy?

The vacuole hypothesis leads to the following dimensional statements, with  $P$  = pressure,  $\rho$  = density,  $L$  = length. Then:

$$\text{gravitational mass, } M_g \quad \text{--} \quad [M] = [\rho \cdot L^3] \quad [7.1]$$

$$\text{inertial mass, } M_i \quad \text{--} \quad [M] = [P \cdot L \cdot T^2] \quad [7.2]$$

$$\text{kinetic temperature, } K_k \quad \text{--} \quad [K] = \left[ \frac{P \cdot N}{\rho} \right] \quad [7.3]$$

$$\text{energetic temperature, } K_e \quad \text{--} \quad [K] = \left[ \frac{P}{\rho} \right] \quad [7.4]$$

$$\text{potential difference,} \quad \text{--} \quad = [L \cdot P] \quad [7.5]$$

$$\text{permittivity, } k \quad \text{--} \quad \left[ \frac{1}{P} \right] \quad [7.6]$$

$$\text{permeability, } u \quad \text{--} \quad [\rho] \quad [7.7]$$

$$\text{energy, } E \quad \text{--} \quad \left[ \frac{L^2 \cdot M}{T^2} \right] = \left[ \frac{L^3}{P} \right] \quad [7.8]$$

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Discrepancies and unsolved problems obviously exist and one of these is especially relevant: the difference between velocity seen as a simple ratio between distance travelled and elapsed time, and velocity as a fraction of the speed of light in a vacuum. Existing dimensional statements do not adequately take into account these well-recognized and well-understood facts, within some circles, distinctions. In this essay an attempt is made to deal with these and other related inconsistencies.

### **7.4 THINGS ARE NOT WHAT THEY SEEM.**

If you hit a large rock with a sledge hammer, you may note that the rock is hard. If the blow was not strong enough, the sledge may bounce off the rock, hurting your hands by transferring the force of the blow into resonant vibration of the wooden handle. This little story is not a speculation.

A relevant and widely accepted speculation holds that the sledge and the rock, and your hands, are made of atoms. Further, each atom consists of a nucleus where most of its mass resides, surrounded by a shell of electrons, and “electron cloud.” The atoms in the rock, the sledge, the wooden handle and the hand are separated by precisely measured “bond lengths.” In short, most of the

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volume of the iron, silicate, wood, and flesh is electrons! Electrons are hard!  
Things are not what they seem!

We walk on floors made of electrons, with feet made of electrons, breathing air made of electrons. How long do you think a speculation like that would have survived prior to the days of J.J. Thompson, who “discovered” the electron 100-odd years ago?

When anything moves, it gains weight. The faster it goes, the heavier it gets, but it can go no faster than a fixed limiting velocity. At that limiting speed, it becomes infinitely heavy. Try that speculation on a nineteenth-century physicist!

### **7.5 ESSAY ON DARK MATTER**

Gravitational effects, observed by astronomers, do not match the amount of matter that is seen; that is, about six times more observable matter should be seen. There may be two sources for what is missing. Some of this matter probably belongs to dark objects and dust far away from stars and far beyond the observable envelope of galaxies. But, a large part of this missing mass may belong to the background “stuff” suggested in the Theory of Vacuoles; the theory suggesting that, when we measure mass, we are actually measuring the

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virtual image of what should be measured, which, in turn, may have unaccounted continuity throughout the Universe. In other words, we are measuring the mass of the illusion we see, which is only a little part of the whole set that should be measured. To make up for such shortage of mass the String Theory has to invent new families of particles that have never been observed, in other words it may make things unnecessarily complicated: we don't need that.

The vacuole hypothesis yields an explanation: the missing mass lies outside our 3-D Universe, as illustrated in figure 6-1. This speculation leads to several interesting possibilities, and even to the possibility of extracting this hidden mass/energy from the Universe for useful applications.

Neutrinos, allegedly originating in the sun, interact in several ways<sup>29</sup> with earthly matter: for example  $^{98}\text{Mo}$  is converted to  $^{98}\text{Tc}$ ,  $^{71}\text{Ga}$  to  $^{71}\text{Ge}$ , with an increase in energy. The ill-fated "cold fusion" experiments may have inadvertently used a neutrino-deuterium reaction, which may or may not have taken place in a Utah beaker. Can we find a way to draw on the Universal neutrino sea for our energy requirements? I believe we already do! I believe that the energy of the mind draws continuously on a Universal mind... but that is not science, someone may object, or is it? Obviously, it is very difficult to find a place where to draw the line.

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This was the question pondered by the Cambridge Club, and rejected as unscientific, even today.

It seems to us (Oliver Ingamells and me) that Science is on the verge of the next big step forward: before this step can be taken, there must appear another Galileo, another Einstein, who will be brave and wise and lucky enough to trample down yet another hard-held dogma and free us from its confines. This all begs for the recommended change in paradigm suggested throughout this essay.

Suggestion: to begin, let's look at the neutrino, a simple act that Science can perform in good conscience!

### **7.6 ESSAY ON DARK ENERGY**

As a natural result of the Theory of Vacuoles, our background "stuff" holds energy of its own, and, of course, it carries the energy we are more familiar with through vacuoles and their associated waves, within what we have called a "shell" as illustrated in figures 2-1 and 2-2. So, there should be an energy field throughout the entire Universe acting gently on everything that is; this is indeed a lot of energy. Therefore, there is no such thing as energy in a vacuum, a

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vacuum that actually does not exist; it is amazing how much damage an incorrect paradigm can do!

This energy does not have to explode in extravagant quantities as predicted by quantum theory. Instead, it is unlikely to be a random energy and it is highly possible this energy is actually part of a non-random process that has something to do with universal consciousness or we should say in more prudent language, universal entanglement. In other words, it uses this energy cautiously, where needed, to create new worlds as we know them.

### **7.7 THE MYTH OF CREATION OUT OF NOTHING**

It is amazing that with all our science today we still have absolutely no clue about the mechanisms that created matter as we know it. The Theory of Vacuoles offers an interesting perspective as it eliminates matter and cleverly replaces it by something made of the background “stuff” itself; it is all waves in that perhaps rigid medium and there is nothing else. So, there is no need for a Big Bang. There is a need for something far more in line with the thinking of a famous astronomer, who I have admired since I was young, Fred Hoyle. His observations led to his alternative theory called the Steady State Theory. Fred Hoyle suggested for a long time that it looks like new particles are continuously created... and they are; it is an undeniable fact. Furthermore, as space

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expands, these particles are created fast enough that the overall mass density of the Universe remains constant.

It appears that we may explain a lot of things with the Theory of Vacuoles, and it does not have to be complicated by the creation of many particles we never saw and never will. Frankly, what is the point of creating particles having a millionth of a second life expectancy to explain this quite stable Universe around us?

### **7.8 COLLISION AND INTERACTION BETWEEN VACUOLES**

In our standard research on fission and fusion processes, **brutal forces** between particles are used to look at the possible effects liberating considerable energy. Basically, we tamper with nature by creating total chaos; and, of course, it takes a lot of time for nature to repair the damage through well-known unwanted decays. To make an analogy, this is the military way of doing business: fire a canon, blowup the cathedral, so that we can deduce from the rubble how that beautiful monument was created. However, if particles, as we know them, do not exist and, if they are replaced by vacuoles with vibrating shells, perhaps there are other new ways to trigger fission and especially fusion. We may use waves to perform deterministic and gentle “surgery” on vacuoles or assemblages of vacuoles. The question is: how do we learn to do this?

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The old model of breaking a drop of water may now make much more sense since particles are no longer made of a solid mass, but instead of a vacuole surrounded by a shell essentially made of waves. In figure 7-1, a neutron vacuole will come in contact with an atom made of an assemblage of vacuoles, for example, uranium. On contact, the oscillations in the shell of the vacuole assemblage are greatly disturbed. The position of positively charged proton vacuoles is completely rearranged. Some proton vacuoles may suddenly repulse each other and ultimately split the vacuole assemblages into smaller vacuole assemblages with a release of considerable energy. This water drop model is not new, and goes all the way back to school models, however when thinking in terms of vacuoles it makes the comparison even more striking. The question is: how could a laser do the same thing given some precise conditions such as frequency (i.e., energy) and wavelength? Or, perhaps a low energy neutron, under some conditions, may be able to perform a more gentle surgery, liberating an attractive amount of energy, and still not creating a situation in which we lose control.

## The Theory of Vacuoles and LENR

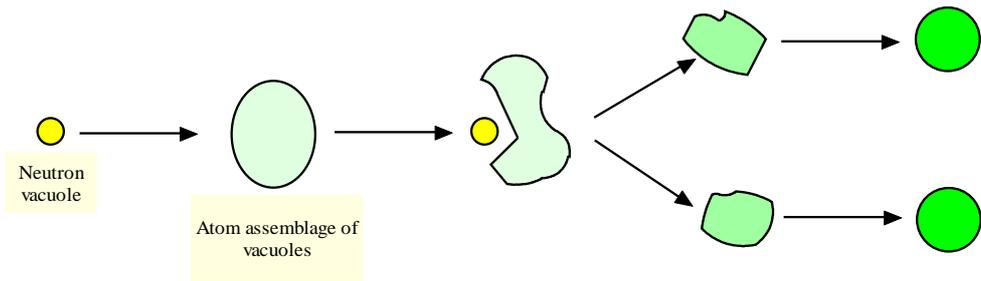


Figure 7-1. Illustration of the fission drop of water model

Now, we may also wonder about the reverse phenomenon using light vacuole assemblages, such as, a proton vacuole and a tritium vacuole that would fuse together to produce helium 4. When looking at this model, we may wonder why it requires so much energy to trigger fusion. Again, if the shell of vacuoles is made of waves, then proper conditions of frequency interferences, proper harmonic oscillators and addition of waves may do the trick. Answers to these speculations reside in a far more in-depth study of the properties of the suggested vacuole shell. This essay only explores possibilities and, obviously, does not provide these answers that require intensive research; we just suggest **performing research in a different way.**

## The Theory of Vacuoles and LENR

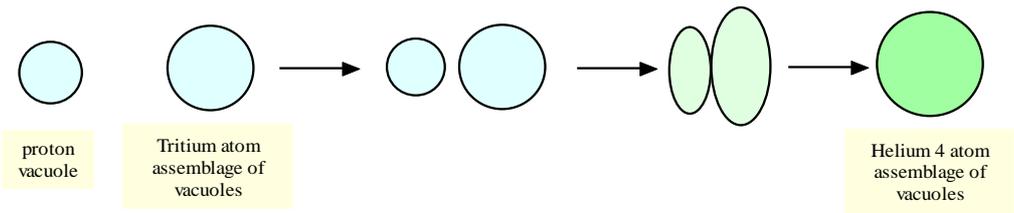


Figure 7-2. Illustration of the fusion drop of water model

### 7.9 A NEW VIEW OF THE COMPTON EFFECT

In the conventional model of the Compton Effect, when a photon, which can be an X-ray or a Gamma ray, collides with an electron, an exchange of energy takes place. The frequency of the deflected photon increases if it gains energy, or diminishes if it loses energy.

In figure 7-3 let's consider a photon with an energy  $h \cdot \nu$  prior to the collision. Let's also assume the electron is static at point zero where the collision will take place which is naive. The deflected photon would have energy of  $h \cdot \nu'$  and  $V$  would be the speed gained by the electron. The moving vector of the electron would be  $m \cdot V$  and its kinetic energy would be  $\frac{1}{2} m \cdot V^2$ .

The deflection angles are  $\alpha$  and  $\beta$ . Principles of energy conservation and the quantity of movement are both applicable to such a collision.

On one hand we would have:

$$h \cdot v = h \cdot v' + \frac{1}{2} m \cdot V^2 \quad [7.9]$$

On the other hand, for the components along x and y of the quantity of movement:

$$\frac{h \cdot v}{c} = \frac{h \cdot v'}{c} \cos \alpha + m \cdot V \cos \beta \quad [7.10]$$

$$0 = \frac{h \cdot v'}{c} \sin \alpha - m \cdot V \sin \beta \quad [7.11]$$

Now, what would have to change in figure 7-3 when taking the Theory of Vacuoles into account, since photon and electron, as we know them, no longer exist? We could make an attempt to find a new model where only waves in the background “stuff” are taken into account. One thing is sure, we can no longer talk about a collision but, instead, a more subtle interaction between waves of various wavelength and frequencies; interaction between closed strings may offer new possibilities. Perhaps, the String Theory could resolve this problem for us.

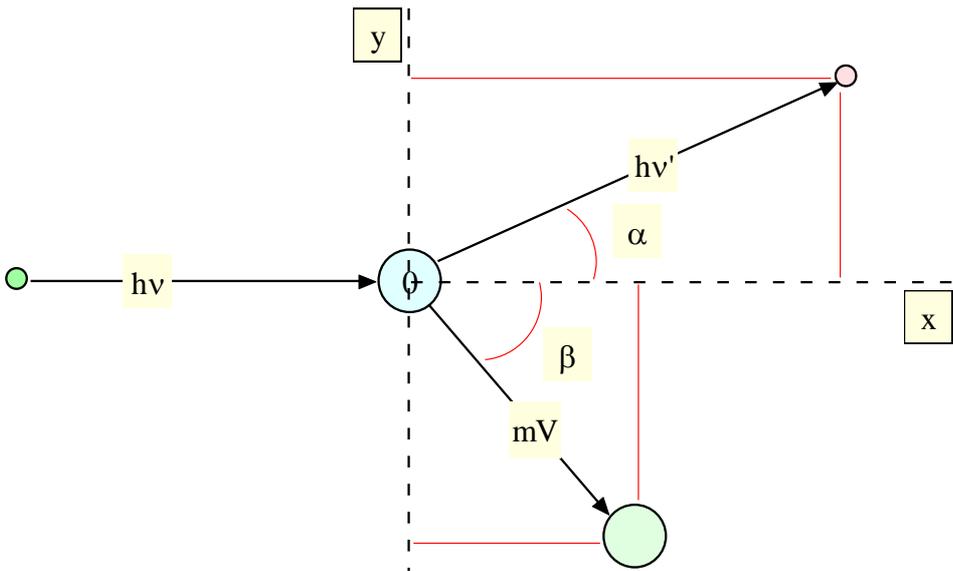


Figure 7-3. Standard illustration of the Compton Effect

## 7.9 “FREE” ENERGY

In Ruderfer’s 1975 article, “Neutrino Structure of the Ether”<sup>6</sup>, his final sentence reads, **“It should be noted that the existence of a vast store of energy in the Universe which can react with matter may be directly pertinent to the urgent need for non-chemical forms of energy suitable for human use.”** Only now, 35 years later, is this speculation gaining credence. It took 160 years for Science to glimpse the importance of Faraday’s rotating magnet experiment. Since it was inexplicable in terms of the “Standard Model,” it was shelved and

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forgotten, as was the work of Ruderfer and many others. B. de Palma<sup>41</sup> has drawn new attention to it. His work carries the same message as Ruderfer's.

The November, 1990, issue of Spec. Sci. Tech. puts the pieces of a very large jig-saw puzzle on the table. Many are flawed or misshapen; many are missing, but they shall be found, reshaped, and eventually arranged into a picture of huge dimensional Standard Model; join Mendeleev!

May I suggest that Faraday's "Free" energy is or was due to the focusing of "flavored" neutrinos, everywhere available, by a rotating magnetic/electric field? Exploring this possibility would be relatively inexpensive and might lead to astonishing results. Credit for any success should go to Dr. Honig and his successors, who gave the world a forum where new perceptions can be presented and discussed, rather than rejected out of hand.

### 7.11 THE ELECTRON, THE POSITRON AND THE NEUTRINO

The mass of the electron is an established physical constant, as is the mass of the proton. The ratio  $\frac{m_P}{m_e}$  is about 1836. No one has been able to explain this ratio. Louis De Broglie<sup>16</sup> has explored the problem, and concludes that "The

**problem of mass is very difficult, and one cannot say when or how it will be solved.”**

The vacuole hypothesis provides an answer. The electron shell that surrounds the central vacuole or vacuoles is mostly **outside** our universe as suggested in figure 6-1. Only that fraction of the electron that lies inside our universe affects our mass measuring device. **The electron has the same mass as the proton, but is inside our universe only 1/1836 of the time.** But, the positron is the mirror image of the electron: think about it! Would it be conceivable that the positron and proton, which carry exactly the same charge (coincidence!), are actually exactly the same thing? The neutrino is a Jacques “heart field”<sup>8</sup>, an electron-positron pair. For speculations on the character of the electron and neutrino, see Ruderfer<sup>4,5,6</sup>, Simphony<sup>12</sup>, and Aspden<sup>42</sup>.

The neutrino we describe here is the ultimate quantum unit (one may say it is “flavorless”!). For recent work with neutrinos, see<sup>43</sup> and also a beautiful article by Bahcall<sup>29</sup>.

The electron has mass, electric charge, a magnetic moment, and a fixed amount of angular momentum (spin). Of these four characteristics, any one of them can

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be derived from the other three. The magnetic moment is related to mass, charge, and spin through a dimensionless constant, the  $g$ -factor, which can be measured and also calculated with astonishing precision and accuracy. The latest reported value (1986) is 2.002319304386(20). In this essay, we have chosen half this number as the factor. Figure 6-1 is a 2-D representation of a portion of the 3-D Universe about the size of a single atom confined between + and - planes  $2 \cdot t \cdot r = \ell_{ec}$  apart, and set in the 4-D Universe. Shown are an electron and a positron within the hyper-spherical cloud of electrons and positrons surrounding the nucleus (vacuole). The circle at the centre in the figure represents a unit vacuole with radius  $r$  and unit surface and volume. An electron-positron pair (a Jacques “heart-field”) is shown in the n-D Universe. The two concentric circles should be regarded as a toroid, and the 4-D electron-positron-neutrino shell may be visualized by rotating this toroid out of the plane of the paper to form two concentric hyper-spheres that contain the electron-positron-neutrino cloud having the mass of the atom. A  ${}^4_2\text{He}$  vacuole with four unit surfaces and 8 unit volumes is drawn in, although the combination shown cannot exist. Note that it is impossible to draw this figure to scale. For the meaning of the + and – see Honig<sup>44</sup>, who assumed two oppositely charged continuous superposable fluids.

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Figure 6-2 is a representation of the 3-D Universe and the 4-D Universe, set within the n-D Universe. If the Big Bang theory is correct, the curvature of the universe has a radius R. The parallel curved lines contain the 3-D observable universe and are part of the spherical or ellipsoidal finite, but unbounded, entity with time-thickness  $2 \cdot t \cdot r = \ell_{ec}$ . Figure 6-1 should be imagined in the position shown. The 3-D Universe may be seen as a 3-D wave (everything is waves anyway) of wavelength and amplitude  $2 \cdot t \cdot r$  - a curved hyper-cylinder, that proceeds outwards, perhaps at the speed of light. Note again that it is impossible to draw this figure to scale.

The time-thickness constant may be calculated from  $g$ :

$$g^{\frac{1}{4}} = 137 \cdot a^2 (1 - a^2)^{\frac{1}{2}} \quad [7.12]$$

whence  $a = 0.00729734975179$  and  $t = \frac{1}{2 \cdot 3^2 \cdot \pi \cdot a} 2.42332945\dots$  compared

to  $t = 2.423328345$  calculated from the 1986 value for  $a$ , which carries a greater uncertainty [0.00729735308(33)]. It may be noted that the vacuole picture of the atom differs from the Standard Model<sup>45</sup> very seriously. It also differs from Jacques<sup>8</sup> conjecture that the proton is made up of 256 "heart-fields."

The vacuole hypothesis suggests that the mass of atom resides, not in the

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nucleus, but in the electron shell, which is populated with a large number of neutrinos and a few electrons. The neutrinos gravitate into the shell from the surrounding neutrino sea, attracted by the central vacuole or vacuoles. C.O. Ingamells<sup>46</sup> wrote, "... given the proper equipment, any 'particle' of any mass and any charge can be manufactured." The proliferation of "particles" during the past several years seems to support this presumption. The 31 pages of "particles" listed in the CRC handbook were generated by expensive "atom smashers." This approach is like firing a canon into a cathedral and trying to deduce the interior architecture by examining the chunks that fly out. The size of the chunks depends on the canon. The "Standard Model"<sup>31, 32, 40</sup> was developed in this manner.

Pisello<sup>47</sup> suggests, based on Einstein's ideas, that the electron is homo-topically invariant in a unified field and that the topology of this field is necessary for understanding. On the flyleaf, Dr. Pisello writes, "This treatise is a statement that commonly accepted theory of Quantum Mechanics cannot survive. It presents the basis for a major new development in physical theory."

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The following **oversimplified** calculation is offered in support of our theory about the  $1/1836$  ratio of  $\frac{m_p}{m_e}$ . The electron “cloud” or “shell” surrounding an atomic nucleus or any other collection or cluster of vacuoles may be conceived as a 4-D volume contained between two concentric hyper-spheres, one of radius  $(a + t \cdot r)$ , the other of radius  $(a - t \cdot r)$ , where  $a$  is the Bohr radius and  $2 \cdot t \cdot r$  is the time thickness of our universe. Please refer to figure 6-1 and its caption and recognize that the electron “shell” is almost certainly not exactly spherical! The calculation cannot, on this account, be exact.

The volume of a 4-D “sphere” is given by Sommerville<sup>30</sup> by:

$$V = \frac{\pi^2 \cdot a^4}{2} \quad [7.13]$$

where  $a$  is the radius, in this case the Bohr radius:

$$18 \cdot t^2 \cdot r = \frac{h^2}{4\pi^2 \cdot me^2} \quad [7.14]$$

And the volume between the two hyper-spheres that contain the electron “shell” is:

$$V_t = [\pi(t \cdot r)^2 (2 \cdot t \cdot r)(2\pi \cdot a)] \quad [7.15]$$

## The Theory of Vacuoles and LENR

Putting  $a = 18 \cdot t^2 \cdot r$  with  $r = 1$ , some algebra gives a ratio, the ratio of the total “volume” of the electron to the observable “volume” it occupies in our 3-D universe:

$$\frac{V_0}{V_t} = 2^2 \cdot 3^4 \cdot t^2 = 1902 = 1836 \times 1.036 \quad [7.16]$$

with some approximations, it is not very far off. Using the unitary system suggested by the vacuole hypothesis, the calculation is easy. The result is the same when the *cgs*, or *MKS* or *SI* system is used, but it becomes somewhat troublesome! One of the early attempts to establish a firm value for the time thickness constant  $t$  used this approach. It yielded  $t = 2.38$  and this value did not satisfy its relation to the periodic table of the elements, which requires a value near 2.423.

Attempts to determine the “ellipticity” of the electron “orbit” met with only marginal success, and are not worth reporting.

If the equation for the volume of the electron shell is written:

$$V_0 = \frac{\pi[(a + x \cdot t \cdot r)^4 - (a - y \cdot t \cdot r)^4]}{2} \quad [7.17]$$

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where  $x + y = 2$ , insertion of various values for  $x$  and  $y$ , yield various values of

$$\frac{V_0}{V_t}.$$

If  $x = 0.4776$  and  $y = 2 - x = 1.5224$ , as suggested in figures 6-7 and 6-8, then:

$$\frac{V_0}{V_t} = 1836.3\dots \text{approximately the measured ratio } \frac{m_p}{m_e}.$$

**The coincidence is too good to be ignored by a scientist.**

Furthermore, in chapter 3 we demonstrated that the electric charge has the dimension of a surface [ $L^2$ ], which clearly suggests that the electron and the positron should have similar surface areas. Obviously, this would strongly suggest that the positron and proton have a lot in common as they have the same charge, but opposite; it all depends on which universes you look for them. If so, this should be a game changer in Nuclear Physics. Our approach has been consistent all along, which shows that we must be doing something right.

Figure 6-5 is a 2-D picture of the Bohr hydrogen atom, with the addition of the “time-thickness” concept. This figure is, as far as possible, drawn approximately to scale. The two concentric circles represent two concentric 4-D hyper-spheres, and an electron is contained within the resulting hyper-annulus. The two parallel lines represent our 3-D universe. At the center of the diagram is a  $2/2$  vacuole,

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the nucleus of the hydrogen atom, drawn larger than what it really is. Remove the electron shell, and it becomes a proton, not by itself, but with a shell of neutrinos that give it its positive charge and its identity as a particle.

Figure 6-6 shows a portion of the electron shell, within which Schroedinger's cat has been drawn to indicate that the electron is not a particle, but a continuous entity, as illustrated by a probability curve. Just as the vacuole at the core of the proton has two unit surfaces, the electron carries a duality that leads to the shape of the probability curve.

Figure 6-7 shows that the Poisson probability with  $Z = 2$  fits the distribution of the electron within the 1 = electron shell, when  $x = 2 - y = 0.4776$ . In the 3-D world, the electron appears as a "particle" with a dual character and apparent

$$\text{mass } \frac{m_p}{1836}.$$

From here, the perception of electrons (other than those in hydrogen atoms; for example in power lines) becomes a possibility. The wave-particle duality is easier to understand. Maxwell's equations may, perhaps, be viewed in a new perspective.

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From hydrogen to the heavier atoms, the principles outlined herein, when married to existing well-established knowledge and theory, may lead to very interesting developments, some of which may be uncomfortable within an “Establishment” that strives toward truth, but, like many human establishments, finds itself at a dead end.

This harsh statement from Oliver Ingamells definitely takes momentum when a 2010 article in Scientific American written by Davide Castlevecchi<sup>26</sup> shows that, with all our advances in today’s physics, we are still at odds about the real mass of a proton, and by a big difference. Something is obviously wrong in the ways we have looked at particles. All we have been able to do is to patch the problem instead of taking the right step and change the paradigm.

In conclusion, positron and electron pairs, created in the sun, perhaps as explained in figures 5-1 and especially 5-2, must carry some truth. Given this, we may seriously think about neutrinos being some combination of electrons and positrons as further illustrated in figure 7-4 for a single pair of electron and positron. Some people wonder if neutrinos oscillate or have mass of their own; it is our view we will never understand what neutrinos really are as long as we

## The Theory of Vacuoles and LENR

insist on giving them properties, instead of giving these properties to the only thing there is that surrounds their vacuole. This mistake is the main reason for the failure of our standard model of particles.

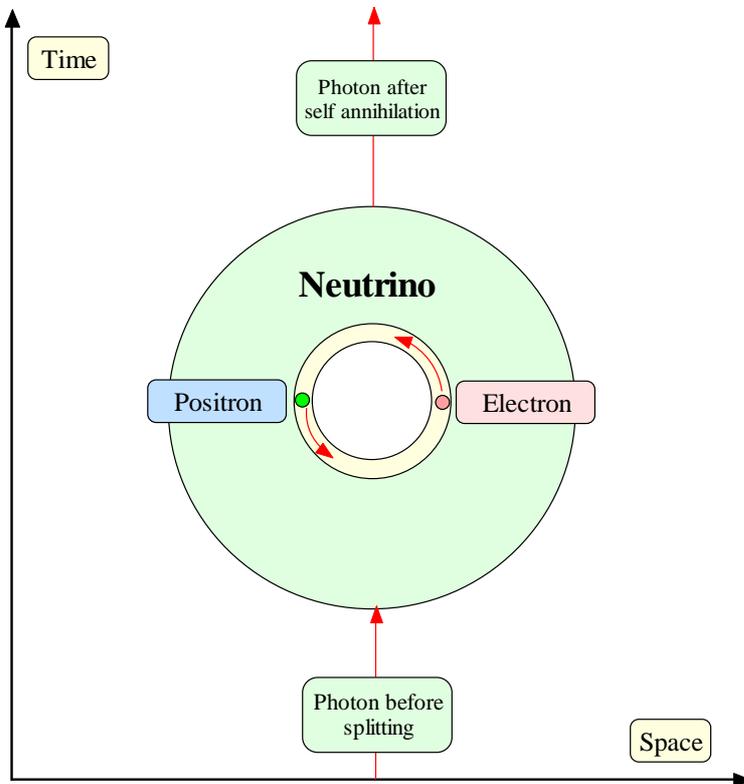


Figure 7-4. The various kinds of neutrinos could be combinations of electrons and positrons, living together under specific conditions yet to be discovered.

## 7.12 SCHROEDINGER, RYDBERG, and the CAT

In an attempt to communicate, our Vacuole Hyper-sphere approach (VH) has:

1. Denied the reality of "particles," and
2. Made pronouncements about particles such as the electron, the proton, the positron and the neutrino.

This is called the VH Cat, analogous to Schroedinger's cat with a little Rydberg thrown in to further confuse the "Standard Model," which was known to Galileo Galelei as "The Pope" or "The Church" in his *Dialogue on the Great World Systems*, which is a condensed version of the Salusbury translation, University of Chicago Press, 1955. Galileo's speculation applies to more than simply the roundness of the Earth and the relationship between the sun and earth in space. For his pains, he was rewarded with excommunication, just as expression of new truths is, today, rewarded with ostracism. Well, it is not nice to confuse the Pope!

VH made a first try at resolving its Cat in the former section. The electron is not a particle! It is an identity existing in a 4-D toroid, Which is equally present, from the n-D point of view, everywhere within this 4-D toroid, but also appearing in

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our 3-D universe only 1/1836 of 3-D "time," at 3-D places at least

$$2a_0 = 36t^2 \cdot r = \frac{h^2}{2\pi^2 me^2} \text{ apart -- much farther in a Rydberg atom.}$$

In the Bohr Hydrogen atom, adding energy results in the electron jumping into ever higher "orbits." VH proposes that this is equivalent to an expansion of the 4-D toroid. As it expands, the two, or more observable 3-D "positions" of the electron or electrons are farther apart than they were in the "unexcited" atom, while the two, or more possible "positions" are exactly equivalent. There is no 3-D way to exactly locate the electron because it is not a "particle" in any n-D perception: it is a condition of the hyper-spheroidal field surrounding the vacuole (proton) that generates it, and toward which it gravitates<sup>48</sup>.

**VH insists that a similar argument is applicable to all 3-D "particles," including photons. What seems to be a "particle" in our 3-D Universe -- a thing with mass, spin, color, strangeness, flavor, wavelength, etc... -- is no more than an observation of a point of intersection with the n-D Universe, or, in the case of the "strongly-interacting particles," simply a 3-D hole or vacuole.**

The VH Cat illustrated in figure 6-1 is not much different than Schrodinger's Cat! It is an attempt to explain n-D to a 3-D "Establishment."

Attachment of such perceptions to quantum theory or mechanics does not change the success or the importance of these disciplines much, but does draw attention to some of the puzzles that emerge from them and helps us understand the "real" 3-D world/universe wherein we find ourselves. The stuff of the world is mind Stuff! The "One" thing that is forever, is the truth!

### 7.13 GRAVITATION

There has always been some uncertainty about the constancy of the gravitational constant. Stephenson<sup>47</sup> discusses this, referring to work at the National Bureau of Standards. The conventional dimensions of the Newtonian

Gravitational constant,  $G$ , are  $\left[ \frac{L^3}{M \cdot T^2} \right]$ . Dimensions of the gravitational

constant  $G_R$  of general relativity are  $\left[ \frac{T^2}{L \cdot M} \right]$ , the relation between the two

being  $G_R = 8\pi \frac{G}{c^4}$ . If one uses the conversion factors  $L, N, T$  and puts  $c^4 = 1$ ,

$$G = 2 \frac{N \cdot T^2}{L} = 6.713 \dots \cdot 10^{-11} \text{ m}^3 \text{ kg}^{-1} \text{ s}^{-2}.$$

The calculation depends on the value assigned to  $N$ , which, in turn, depends on the arbitrary selection of a nuclidic mass scale. Since the universe is mostly hydrogen, with a small contribution from the other elements, a mass scale based on hydrogen would make more sense in this connection. This leads to a correction factor of 0.994, yielding  $6.673 \cdot 10^{-11} \text{ m}^3 \text{ kg}^{-1} \text{ s}^{-2}$ . It seems that  $G$  is not a true constant, but depends on an as yet unappreciated relation between  $G$  and mass defect, on the composition and density of local matter and other factors,<sup>46, 47</sup>.

Einstein recognized this and maintained that the atomic particles are held together by gravitational forces: it is by this process that the vacuole or vacuoles at the core of an atom attract a cloud of neutrinos, thereby giving the atom its mass. Since we don't understand the behavior of neutrinos, do we really understand what mass is?

## 7.14 THE CAMBRIDGE CLUB<sup>49</sup>

During the 1930s, at Cambridge, high-ranking scientists led by Sir Arthur Eddington seriously discussed the effect new developments in Physics such as Relativity, Uncertainty, the Quantum, and n-D space had on their perception of

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our world. They were awed by the philosophical implications of these new developments and attempted to replace shattered beliefs and points-of-view. The result is best expressed in Eddington's statement: "The stuff of the world is mind-stuff."

Faced by the unwelcome reality, as things are not what they seem, physicists who glimpsed the truth and felt the awe turned their backs on it, rejected it, and insisted that others reject it too.

If you hit a rock with a hammer, you are convinced that the hammer and the rock are hard and solid; yet you know that both are composed of atoms, which is a minuscule nuclei surrounded by swarms of electrons and that your physical self is so composed.

The vacuole hypothesis suggests that the Universe is a neutrino sea, an n-D honeycomb<sup>30</sup>, but more likely elliptic, with each cell a flavorless neutrino.

We, individually and collectively, are concentrations of this "*Ether* stuff" honeycomb, as are all things and beings we see, touch, smell, hear, and believe. We cannot visualize or describe the Universe, or even our own 3-D

Universe from outside it, because we are inside, a tiny part of it and of each other.

Therefore, the world is mind-stuff.

### **7.15 PERPETUAL MOTION AND “FREE” ENERGY**

First, making a clear distinction between “free” energy and the free energy of thermodynamics is necessary. Those who would extract “free” energy from the cosmos, the Universe, or wherever are not talking thermodynamics, they are talking about something like perpetual motion, which is an idea that has been promulgated for centuries, and which has been rejected by Science and promoted by a variety of sincere original thinkers and also by charlatans of all flavors.

Martin Ruderfer, author of numerous speculations papers, and I had many discussions on this subject. His wise conclusion was that “free” energy is energy that comes from somewhere else. He offered a very simple example. “I know how to build a perpetual motion machine! Set up a Foucault pendulum. Many very large ones exist. Each requires a little kick of energy at each swing to keep it going. It otherwise slowly diminishes its amplitude until it finally stops swinging. Resistance of the air through which it must swing is its enemy:

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nevertheless, it generates “free” energy because it slowly rotates the swivel on which it is hung. If one were to mount the whole thing in a vacuum chamber, the daily rotation of its pivoting support might generate enough “free” energy to keep the thing swinging forever, without need for that little externally powered kick per swing. The net result, of course, would be a slowing of the earth’s rotation, but we will have extracted “free” energy from the universe.

Other searchers for “free” energy have turned their sights on a large Universe, within which our universe is set. Perhaps we may be able, somehow, to extract, or steal energy there from. If the Universe within which our little universe is enclosed, is as enormously large as we believe it must be, then extraction of a scrap of its energy to meet our relatively trivial needs will have little effect on it and would benefit us tremendously. The principle is, however, the same as that of the pendulum.

To transfer energy from the Universe to our universe, we must understand that the Universe will demand something in exchange! The price will not be paid in dollars, or pounds or rubles, but it will be paid! We have extracted “free” energy from the Universe! We have used it to build a few power plants, and, also, to kill our tribal enemies. If we manage to find more sophisticated ways to extract

## The Theory of Vacuoles and LENR

energy from the Universe, what shall be the consequences? How will the Universe demand payment of our debt? Armageddon? Oblivion? I don't know. Do you?

## CHAPTER 8

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### FROM THE VACUOLE THEORY TO THE STRING THEORY

#### 8.10 INTRODUCTION

Some people may look at the suggested Theory of Vacuoles as an unwelcome substitute for Quantum Mechanics and the popular String Theory. It is not the case at all. Both Quantum Mechanics and String Theory developed over many years and the acquired knowledge are an undeniable scientific patrimony for mankind; it would be totally inappropriate to challenge these foundations.

However, the Theory of Vacuoles, with its new paradigm, can certainly help resolve some bizarre and sometimes annoying hurdles that have haunted Quantum Mechanics and String Theory. Also, the Theory of Vacuoles can help simplify everything in such a way that we no longer have to rely too much on mathematical models with a billion possible solutions that go nowhere, as far as a good scientist is concerned. The Theory of Vacuoles eliminates the need to

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rely on the existence of an extravagant number of particles that have never been observed and never will be. These imaginary particles, often based on acts of faith, and these extraordinary complex mathematical models were a kind of a necessity to compensate for a faulty paradigm: we don't have to punish ourselves that way anymore. Therefore, the Theory of Vacuoles should be welcome to Quantum Mechanics and String Theory adherents, because it will necessarily open new possibilities that have been overlooked so far, and most certainly may eliminate some of the frustration.

The new version of the omnipresent *Ether*, which is the only thing there is should help resolve the dark matter and dark energy issues in an elegant way. There is no such thing as missing matter; there is only a medium the mass of which has to be redefined, **completely**. In other words, we may have to clean the kitchen a little! Then, and only then, we may look at fascinating new possibilities.

Many details in this essay will be challenged by physicists and mathematicians; there is nothing wrong with this. However, the new, suggested paradigm is **inevitable**; it does not matter if it takes one year, ten years, or a hundred years

to recognize that new paradigm, it is inevitable. Therefore, the sooner the paradigm switch is performed, the faster we shall make progress.

## 8.2 FROM A VACUOLE TO A CLOSED STRING

As effectively suggested by Oliver Ingamells, vacuoles can take various shapes, and preferentially those involving spheres and oblates compatible with the time “thickness” slice  $2 \cdot t \cdot r$  illustrated in figures 6-1 and 6-2. However, there may be other possibilities with the concept of vacuole.

Imagine an electron orbiting a proton, as suggested by the standard model, and illustrated in figure 8-1: basically, it would be a little sphere with a certain mass orbiting another sphere with a much larger mass. What is wrong with this model? **With the old paradigm, the centrifugal force opposing the attraction of electron and proton is necessary.**

## The Theory of Vacuoles and LENR

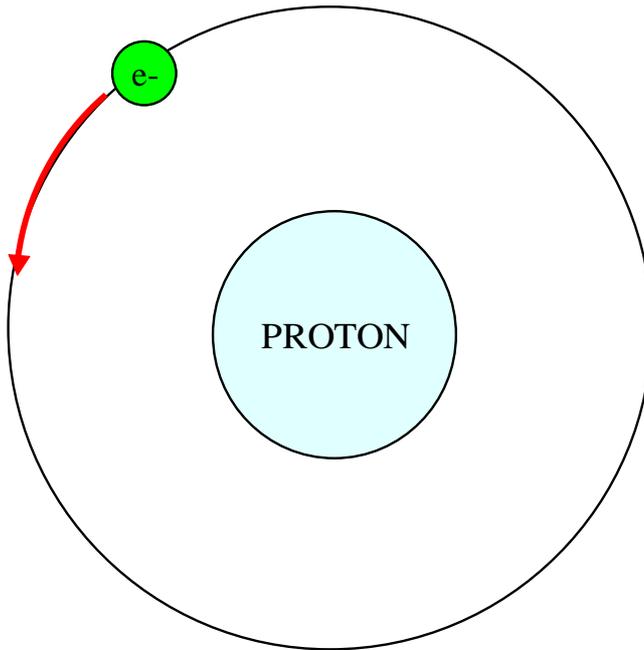


Figure 8-1. A centrifugal force was necessary.

Now, with the new paradigm imagining a negatively charged vacuole in orbit around another positively charged vacuole, we may ask: why would the “electron” vacuole remain a sphere as it travels around the “proton” vacuole at light speed? Would the “electron” vacuole elongate itself to the point that it would become a tube all the way around the “proton” vacuole? Now, we would have a vibrating closed string around the “proton” vacuole, as illustrated in the simplistic sketch in figure 8-2. Not only does the shell of the tube vibrate within

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itself, but the entire tube/string encircling the proton oscillates as well; however, it is not shown in figure 8-2, within the time-thickness  $2 \cdot t \cdot r$ . We would now have a situation where the “electron” vacuole is everywhere at once on its optimum orbit (i.e., sphere) around the “proton” vacuole. **There is no longer a need for the centrifugal force.** The same reasoning could then be applied to many other particles and atoms.

The huge difference with what we say and the String Theory is the fact that the so-called “closed string” is actually a tube with empty space at its center, and therefore there is no need to wonder what created it. In the String Theory, strings wrap around extra dimensions to create particles with different masses. However, if particles vanished, to be replaced by vacuoles, it would suggest that it is the behavior of vacuoles sent at great speed that may create strings in the first place; this would be another necessary paradigm shift. When the first possible existence of strings was noticed inside particle accelerators 40 years ago, such strings may have been created by proton or neutron vacuoles, and not the other way around.

Furthermore, let's assume the tube rotates on itself, then at opposite sides of the orbit around the “proton” vacuole it would, in 3-D appear to spin in opposite

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directions as the tube intersects our 3-D universe. Now, if two electrons orbit a same nuclei, like helium, perhaps it would be logical that each “electron’s” closed string would force the other one to spin in the opposite direction, as they would be two parallel systems, separated by a fairly short distance; this would allow them to eventually roll around each other in a logical way, which is consistent with the standard model of spins, however, **with a simple explanation.**

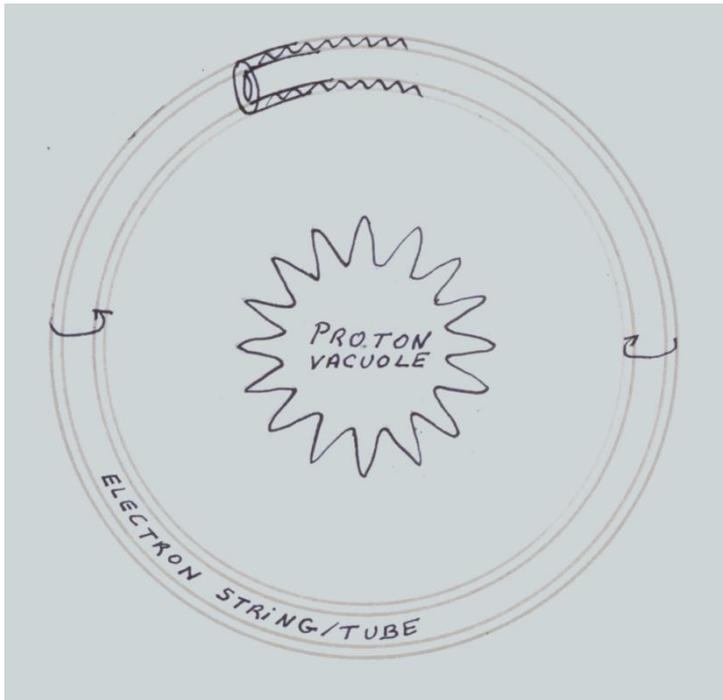


Figure 8-2. The “electron’ vacuole becoming a tubular “closed string” around the “proton” vacuole.

### 8.3 TWO HYDROGEN ATOMS FOR ONE HYDROGEN MOLECULE

When an "electron" vacuole orbits a single "proton" vacuole, the combination may not be as stable as when two "proton" vacuoles share two "electron" vacuoles." When this happens the two orbiting "closed strings" may combine and generate a knot half-way between the two "protons." That knot may have interesting properties that explain the stability of the hydrogen molecule. Knots would be the key to the stability of many molecules. If this is true, then it would lead to an entirely new theory explaining covalences.

Under some conditions, it is not too farfetched to believe that the string "tubes" are kicked out of their orbit and become strings, closed or not, with the known possibilities exposed in the String Theory. So, there is no need for particles to explain the String Theory, but only vacuoles and tubes interacting at different levels of energy. The Theory of Vacuoles would therefore make certain aspects of the String Theory inevitable, **and vice versa**.

## **PART 3**

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“If you cannot explain it simply, you do not  
understand it well enough”

Albert Einstein

## **THE MYSTERY OF COLD FUSION: MYTH OR REALITY**

### **INTRODUCTION**

The subject of Cold Fusion or, we should say Low-Energy Nuclear Reactions is a subject in its infancy, and so our input using the Theory of Vacuoles; nevertheless, we may have something to offer to slightly open the door to a new world. The name “Cold Fusion” is not correct and was given at a time when nobody understood what was going on. It is far more correct to name all these possible and enigmatic phenomena “Low-Energy Nuclear Reactions” because, indeed, it is what happens. Nevertheless, it should also be unsuitable to

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disregard “Cold Fusion” because it is a vocabulary ordinary people who are not necessarily trained physicists may better relate to; to them “Low-Energy Nuclear Reactions” is more abstract and not so easy to remember, but definitely encompasses more possibilities. Furthermore the word “nuclear” is, by itself, sufficient to raise totally unjustified public hysteria. It is exactly like arguing about the word “Ether”; it underlies the fact that we sometimes struggle to find the right words, and also sometimes the right word does not exist or is not appealing. All this may not deter us from analyzing the wonderful, hidden properties of a new world that we have not known exists, because the Establishment raised fences behind which we must learn to behave like ducklings following the mother duck. So, let’s be one of those rare ducklings that takes a sideways path; the poor duckling may make it or may get into trouble; that is life!

## CHAPTER 9

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### LOW-ENERGY NUCLEAR REACTIONS

#### 9.1 THE OBSOLETE INSIDE-OUT PARADIGM

In the inside-out paradigm we are observers. We think that particles make matter, and we have become convinced that matter is the only thing that exists. But, we are prisoners of that 3-dimensional universe limited to the time-thickness  $2 \cdot t_r$ , which clearly says that our senses have access to only a hologram and reality is something very different, hiding in the n-dimensional universe. In many ways, Quantum Mechanics and String Theory understand that point very well. So, basically, matter is not what we think it is and this is where the Theory of Vacuoles can make a significant difference.

The problem we have created is the belief that these two-dimensional models of particles and nuclei cannot be changed without involving huge amounts of energy. Maybe nature is much easier going and, of course, it is very subtle. It is a fact that weak forces can move mountains. I cannot help remembering that “in

the 1980s, on a mountain highway in Colorado, shaggy mane mushrooms literally broke through newly laid asphalt, causing tens of thousands of dollars worth of damage and necessitating replacement of a stretch of the highway”<sup>51</sup>. A shaggy mane is the popular name for that weak, tiny mushroom called *Coprinus Comatus*. Any physicist would tell you that such a mushroom would never carry sufficient energy to break the road the way it did. I personally witnessed a similar phenomenon in the 1970s in New Caledonia where *Boletus* mushrooms broke through one-foot thick concrete runways of an old, abandoned WWII U.S Air Force facility. At the time, as a well-trained chemist, physicist, geologist, and sampling statistician, I had a very hard time believing what I saw and, ever since, I have become far more open-minded and humble about what nature can show us with its well-hidden secrets, talents, and power. Anyone can push on a wall, non-stop for a full day, applying 100 times more pressure with your fingers than a tiny mushroom; at the end of the day, I can assure you it would make absolutely no difference, so something is missing.

## **9.2 THE NEW OUTSIDE-IN PARADIGM**

With the outside-in paradigm, we are all participants because everything is “One.” In that case, particles are no longer what we think they are. Maybe, the

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following 2-dimensional sketch, in figure 9-1, may simplistically explain what is actually happening.

In this sketch, a particle does not exist. There is only a center (shown in black), where there is absolutely nothing, then there is that compressed universal medium or dark matter around it (shown in different shades to illustrate some sort of compressed shell and continuity) giving us the illusion of a particle. In such vacuole, there is a considerable amount of energy stored (i.e., dark energy). Remember, dark energy is an unseen vacuum, a perfect vacuum energy; this is what holds the vacuole together nearly forever, as shown by imaginary arrows. Now, how may such vacuoles interact with other vacuoles or with electromagnetic radiation or photons? Maybe, it is not as hard as what we may think to trigger low-energy nuclear reactions. Furthermore, in that case, **properties attributed for many years to so-called particles are instead properties of the universal medium in proximity to the vacuole; there is a huge difference.** Let's speculate about the photoelectric effect as an exercise. Perhaps, the quantic notion of the Dirac fluid leading to collective behavior is not too far away from what we are suggesting.

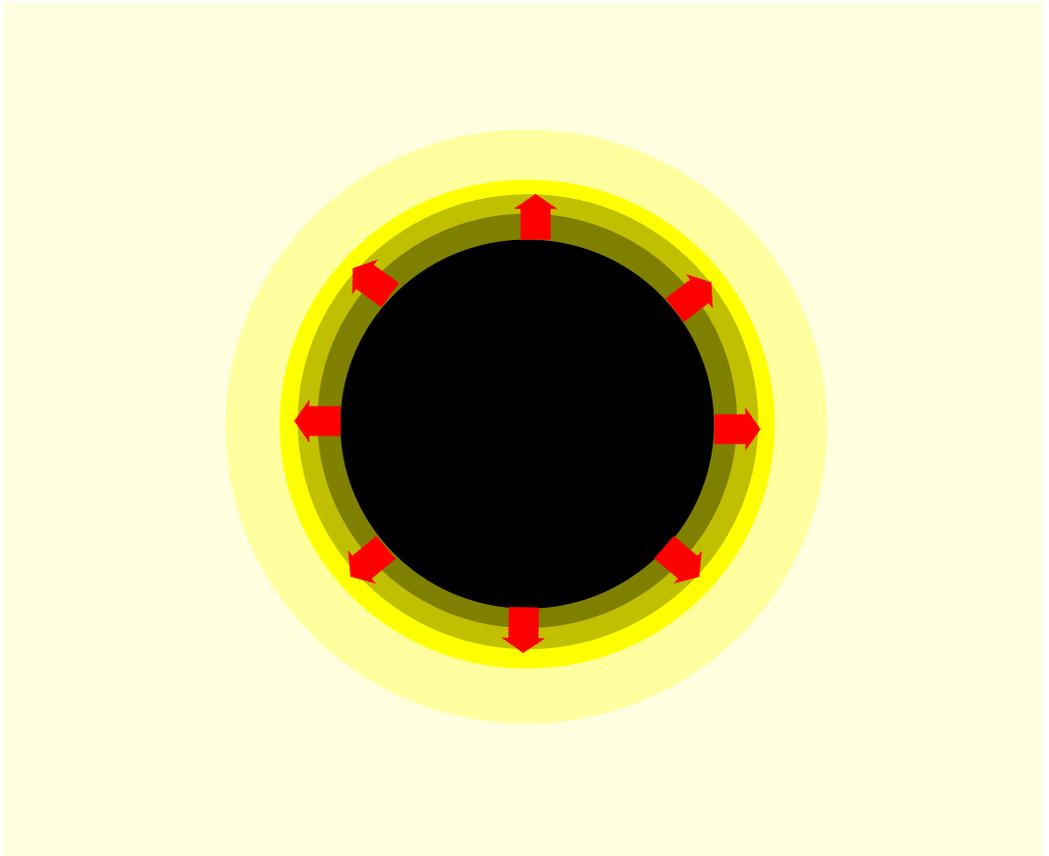


Figure 9-1. Illustration of a vacuole

### 9.3 REVISITING THE PHOTOELECTRIC EFFECT

We may speculate that neutrinos may be neutral combinations of electrons and positrons, the simplest of which is an electron-positron pair. If this approximates

the truth, neutrinos exist “with only a tail” in our 3-D universe.<sup>27</sup> **A basic tenet of the vacuole hypothesis is that a clear picture of our 3-D universe cannot emerge without taking into consideration the n-D Universe in which it is set. The “solar neutrino problem”<sup>29</sup> is not a 3-D problem; it is an n-D problem.** In what follows keep the neutrino concept in the back of your mind. Also, keep mind that the “apparent” mass of a particle in our 3-dimensional universe can be much less than the mass of the same particle in an n-dimensional universe.

According to figure 5-1, a photon travelling close to matter may generate an electron and a positron, which eventually may annihilate one another. Also, remember that, according to the Theory of Vacuoles, the word “annihilation” may not be correct: there is no such thing as annihilation when things go back to normal and a new photon continues its way through space. But, the photoelectric effect shows another well-known scenario: a photon enters photo-emissive material that ultimately generates a photoelectron, as suggested in figure 9-2. The idea is that free electrons on the receiving metal or inside it are pushed away to produce electricity. This may be similar to the propagation of mechanical waves; however, light waves behave differently and perhaps our standard model is a little naïve.

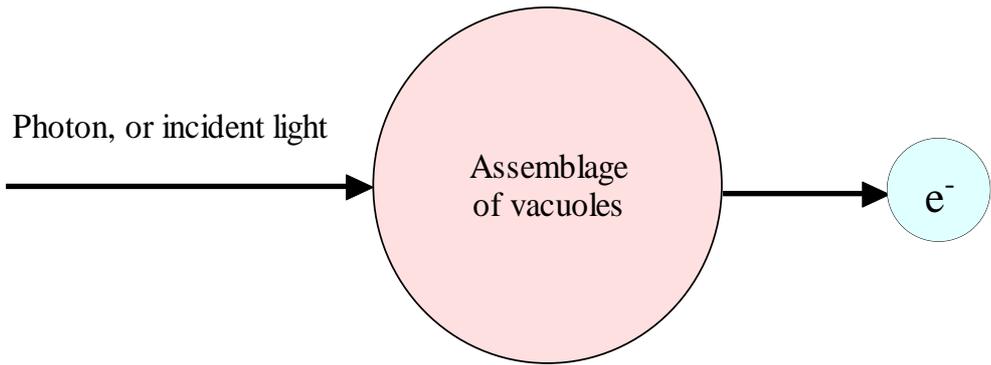


Figure 9-2. Sketch illustrating the photoelectric effect as presently understood

Again, according to figure 5-1, it would not be farfetched to imagine that, at contact with an appropriate assemblage of vacuoles, we may call photo-emissive material/metal, a sufficiently energetic photon created an electron and a positron as expected. Now, we may wonder what happened to that missing positron, which now confined to the 3-dimensional universe of thickness equal to the time thickness  $2 \cdot t \cdot r$  may be considered as a proton (that would be something!). It is likely that, above a certain threshold frequency, the photon indeed penetrated the nucleus inside, which created an electron and a positron. Then, within the excited nucleus, a series of reactions and rearrangements immediately take place to keep the integrity of the nucleus as suggested in figure 9-3. Now, try to forget the spherical representation of the nucleus and

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don't forget we are talking about assemblage of vacuoles, as particles as we know them do not exist. In figure 9-3, the newly created electron immediately interacts with one proton to produce a neutron. Now, we have a missing proton and an excess neutron that may not be welcome. Perhaps, but this is debatable, the positron replaced the missing proton. The excess neutron decays into a proton and the electron generally observed in the photoelectric phenomenon. But, we have a problem with the positron (proton); where does it go? Is it annihilated with another free electron? Does it produce a neutrino with another free electron? Perhaps, it is subtler in some other cases if the positron is actually the same thing as a proton in a  $n$ -dimensional universe, then we would come close to adding a proton in our nucleus, which would be consistent with what is observed in some experiments with Low-Energy Nuclear Reactions. We must refine this idea that is open for new thinking, as what I say above is speculative in nature, but certainly worth more investigation.

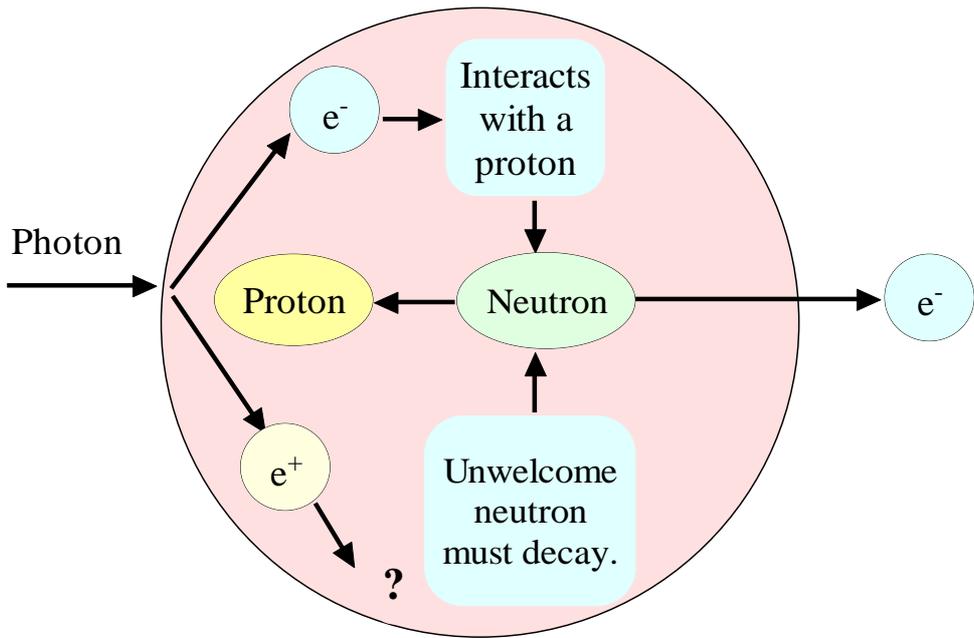


Figure 9-3. Suggested photoelectric scenario taking place within the nucleus of the selected photo-emissive material

#### 9.4 ANTIMATTER, ANNIHILATION, OR SOMETHING ELSE

Antimatter and annihilation are two other concepts or models we developed over the years when two particles meet and vanish from our naïve 3-dimensional universe. The neutron, neutrinos and positive and negative adiabatic fluids making up the universal background medium have a lot in common, perhaps presented in different, evolving ways. We may speculate that a neutron made of

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two vacuoles (proton and electron), though considered as a neutral particle, still contains some kind of structure that may eventually allow it to decay into a proton and an electron when it becomes an obstacle to reach “sacred” stability. A neutrino may be something slightly different in which the negative and positive stuff is well-mixed, still a vacuole, such as a midway particle between neutron and universal background. So, when an electron comes in proximity to a positron, one may observe what appears to be some kind of annihilation as both vacuoles (particles) vanish from our 3-dimensional horizon. They don’t vanish at all; instead they reach an extremely stable, happy universal medium where there is no need for a vacuole anymore. This is a huge difference and these antimatter and annihilation concepts should, perhaps, be redefined carefully because the way they are presented today is, in my view highly misleading. As long as it is misleading, science will not progress much with their understanding.

## CHAPTER 10

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### SUGGESTED WEAKNESSES OF STABLE ISOTOPES

#### 10.1 INTRODUCTION

In this chapter we will make an attempt to calculate the ratio  $\frac{x^{\frac{3}{2}}}{y}$ , which was already discussed at great length in chapter 6. We may use the value of this **ratio for all naturally occurring isotopes** as a good indicator of their relative stability, and see if we can come out with some kind of classification. In other words I reject the concept of stable versus unstable as a magical frontier; rather, I suggest some kind of continuity among all isotopes, even within the population of so-called "stable isotopes." We may start with light elements and finish with the more challenging heavy elements. Such classification, within the family of stable isotopes or isotopes found in nature may have been ignored for too long. As a basic reminder, we use the official electron configuration of elements that considered the order of electron filling as illustrated in figure 10-1.

**A very important remark**

In what follows, it would be inappropriate to believe that we can go away with the Coulomb barrier to trigger fusion, so let's not be naïve on this important issue. We intend to list opportunities and nothing else. To trigger these opportunities, it is of paramount importance to find the proper stimuli: we do not intend to demonstrate what these critically important stimuli might be; but there is ample evidence in nature that they do exist and we may suggest where the exploration should begin.

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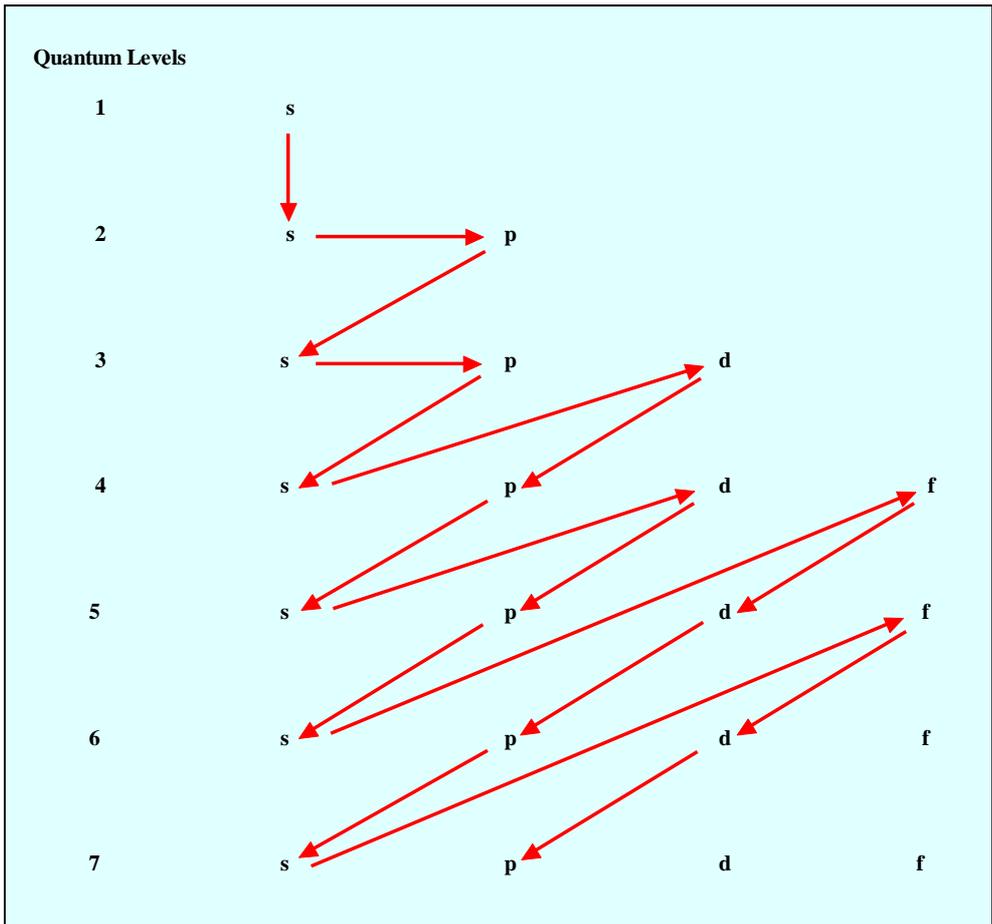


Figure 10-1. Priority order for filling electrons in atoms

In table 10-1, isotopes for one element are ordered from the most stable value

for the  $\frac{x^{\frac{3}{2}}}{y}$  ratio to the least stable. Only naturally occurring isotopes are

considered and, as a convenient reminder, their respective abundance in nature is indicated for possible further discussion.

### **Further comments about vacuoles, assemblages of vacuoles, and neutrinos**

The following discussion may help the reader to better relate known particles with newly suggested vacuoles, which is critically important to better accept the possibility of Low-Energy Nuclear Reactions. Physicists reject most ideas of Low-Energy Nuclear Reactions because, so far, nobody has a logical explanation for them and they seem to contradict some very well understood rules of nuclear physics. Yet, the same physicists make a big deal about neutrinos, a possible particle that they themselves do not understand; it is what you call a flagrant case of double standard when convenient. It is very likely that, with the Theory of Vacuoles, we may understand neutrinos much better. It is generally accepted that when an electron meets a positron they annihilate, but **the Theory of Vacuoles says that the properties of what we see as particles are actually the properties of the universal medium instead.** Then, there is no such thing as annihilation, but simply a return to the normal state of a medium made of two positive and negative adiabatic fluids. Following the same general idea, a neutrino is nothing more than an ideal vacuole made of perfectly

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balanced positive and negative medium. This ideal vacuole may have a lot in common with well-known neutrons, as we know them, in our limited 3-dimensional universe. Some may wonder how so many protons can coexist in nuclei: they need to be protected and surrounded by ideal vacuoles made of perfectly balanced positive and negative medium, and this is the mission fulfilled by neutrons. As atomic weight increases so does the number of necessary neutrons to keep the peace... to a well-known point, of course. Slightly before reaching that point, assemblages of vacuoles are struggling to reach the perfect equi-eccentric spheroids; opportunities may exist under special conditions (e.g., good projectiles and appropriate stimuli) for Low-Energy Nuclear Reactions to take place in a very gentle way to attain the Holy Grail of nature: perfect stability. During four billion years of evolution, nature on Earth, and elsewhere, may have developed plenty of enzymes that enabled them to be the perfect stimuli for such nuclear transmutations. Basically, **it is all a matter of finding the appropriate projectile, ideal target, good stimuli, and any transmutation that leads to better stability becomes a possibility worth exploring.**

### **Comments about charged particle barriers**

Physicists may rightly argue that charged particles, like protons or electrons, are not likely to easily enter nuclei without involving enormous energy (i.e., the Coulomb barrier). However, with the Theory of Vacuoles, where assemblages of vacuoles acting like running drops of mercury, we may wonder if such capture may indeed be easier than what we thought, at least, under some ideal conditions. As we say sometimes, if you cannot enter the house through the front door, you may try the back door or even the windows, as conceptually suggested in figure 9.3. Furthermore, I think we misunderstand the possibilities offered by neutrinos, a particle with “personality,” still vastly misunderstood today. I emphasize the word “personality” because, today, in nuclear physics most principles are based on random or probabilistic events. I strongly believe nothing is random in this world. It is time to respect the likelihood that some events, especially those created by neutrinos, may be more deterministic than what we may think; universal entanglement is then the key. One thing we know for sure is that neutrinos react with terrestrial matter, with an energy increase. We know neutrinos can react with deuterium, freeing the neutron and the proton, which may offer possibilities; even more so when you know about 100 trillion neutrinos go through our body every second. Yes, neutrinos rarely interact with matter, but statistics are overwhelming and many events can

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indeed take place every second out of a staggering 100 trillion passages. Furthermore, intercepts between neutrinos and deuterium or other isotopes nuclei do not have to be probabilistic events when using stimuli; nature may very well have found deterministic ways of creating such events through universal entanglement. It is my view that we won't understand Low-Energy Nuclear Reactions until we start understanding neutrinos much better, starting with the fact that a neutrino is a vacuole and certainly not a particle. Furthermore, the mass of neutrinos may be something in our 3-dimensional universe and something else, heavier, in an n-dimensional universe. Basically, let's keep an open mind on how Coulomb barriers may interfere with Low-Energy Nuclear Reactions as suggested in this essay, which leads, **again**, to the following reminder: **properties associated with vacuole assemblages are not the properties of the vacuoles themselves, but, instead, properties of the n-dimensional continuum within which they exist**, and this is exactly why a paradigm shift is so critically important. Indeed, with the wrong paradigm, some important rules cannot be broken as they are necessary to explain what we see in our naïve 3-dimensional universe. Furthermore, and certainly not the least, remember that we demonstrated that **the electric charge is essentially related to the surface area of vacuoles or assemblage of vacuoles**, which may lead to a necessary revision of the Coulomb barrier.

### **Another way to overcome the Coulomb barrier**

Scientists rightly say that the Coulomb barrier makes cold fusion impossible. But, this is assuming you want to introduce a proton inside the nucleus using brute force. But, perhaps, as suggested in figure 9-3, there is a way to give birth to the proton within the nucleus by passing an electromagnetic gamma ray or a neutrino into the nucleus. Closer to our ways of triggering fusion, perhaps a high-energy laser beam can do the trick. In other words, the deterrence of the Coulomb barrier may not be as critical as what we may think. To use an analogy, behind a dam you have an incredible amount of energy in the stored water. We may break the dam and release all that energy, as is our standard approach today with nuclear energy. Perhaps, there is a better way to slowly use that water behind the dam to produce energy as needed and no more, and it is exactly what we do.

In section 6-16 we indicated that the ideal, most stable value for the ratio  $\frac{x^{\frac{3}{2}}}{y}$  was 1.14. In table 10-1, for future reference, we may consider any ratio between 1.1310 and 1.1490 as very stable and we bolded these values in table 10-1 in **black and a larger font**. On the other hand we bolded the most unstable ratios above 1.18 and below 1.10 in *italic*. This classification is somewhat

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arbitrary from our part, but it will guide us in further discussions. So, let's call the isotopes marked in bold large black font as **good, stable end products** of a low-energy nuclear reaction, and let's call isotopes marked in bold italic black as ***good, potential recipients or targets*** in a low-energy nuclear reaction. The good indicators to look at, if we take the example of making attempts to push a proton into a nucleus, are a combination of a good recipient or target immediately followed by a stable product. Let's analyze a few historical examples that have puzzled many people in the past. Also, keep in mind that nature has no obligation to follow the rules we created during the last 200 years, and I am sure it created amazing stimuli to benefit from weak interactions, and frankly I strongly believe this is an area of science we have ignored in an arrogant way for way too long; beware of the staggering consequences of false negatives for society.

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**Table 10-1**

Isotope	Ratio $\frac{x^{\frac{3}{2}}}{y}$	Abundance in Nature in %
${}^2_1H$	<b>1.212</b>	0.014
${}^3_1H$	<b>2.276</b>	0
${}^4_2He$	1 (sphere)	99.999
${}^3_2He$	<b>1.333</b>	0.0001
${}^6_3Li$	<b>1.22</b>	92
${}^7_3Li$	<b>1.05</b>	8
${}^9_4Be$	<b>1.26</b>	100
${}^{11}_5B$	1.1571	81.0
${}^{10}_5B$	<b>1.271</b>	18.5
${}^{12}_6C$	1.1785	98.89

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$^{13}_6\text{C}$	<b>1.0877</b>	1.0
$^{14}_6\text{C}$	<b>1.01</b>	0
$^{14}_7\text{N}$	<b>1.096</b>	99.64
$^{15}_7\text{N}$	<b>1.023</b>	0.37
$^{17}_8\text{O}$	<b>1.136</b>	0.037
$^{16}_8\text{O}$	<b>1.207</b>	99.76
$^{18}_8\text{O}$	<b>1.073</b>	0.20
$^{19}_9\text{F}$	<b>1.253</b>	100
$^{20}_{10}\text{Ne}$	<b>1.1347</b>	90.92
$^{21}_{10}\text{Ne}$	<b>1.081</b>	8.82
$^{22}_{10}\text{Ne}$	<b>1.032</b>	0.26
$^{23}_{11}\text{Na}$	<b>1.048</b>	100
$^{24}_{12}\text{Mg}$	<b>1.112</b>	78.6

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${}_{12}^{25}\text{Mg}$	<b>1.068</b>	10.11
${}_{12}^{26}\text{Mg}$	<b>1.027</b>	11.29
${}_{13}^{27}\text{Al}$	<b>1.041</b>	100
${}_{14}^{28}\text{Si}$	<b>1.096</b>	92.3
${}_{14}^{29}\text{Si}$	<b>1.058</b>	4.7
${}_{14}^{30}\text{Si}$	<b>1.023</b>	3.1
${}_{15}^{31}\text{P}$	<b>1.098</b>	100
${}_{16}^{33}\text{S}$	1.1518	0.74
${}_{16}^{34}\text{S}$	1.1179	4.2
${}_{16}^{32}\text{S}$	<b>1.187</b>	95.1
${}_{16}^{36}\text{S}$	<b>1.0558</b>	0.016
${}_{17}^{37}\text{Cl}$	<b>1.1488</b>	24.6
${}_{17}^{35}\text{Cl}$	<b>1.214</b>	75.4

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$^{36}_{18}\text{Ar}$	1.1498	0.34
$^{38}_{18}\text{Ar}$	<b>1.089</b>	0.063
$^{40}_{18}\text{Ar}$	<b>1.034</b>	99.6
$^{39}_{19}\text{K}$	1.1295	93.26
$^{40}_{19}\text{K}$	1.1012	0.012
$^{41}_{19}\text{K}$	<b>1.0744</b>	6.73
$^{40}_{20}\text{Ca}$	<b>1.1348</b>	96.97
$^{42}_{20}\text{Ca}$	<b>1.0808</b>	0.64
$^{43}_{20}\text{Ca}$	<b>1.0556</b>	0.145
$^{44}_{20}\text{Ca}$	<b>1.0316</b>	2.06
$^{48}_{20}\text{Ca}$	<b>0.9457</b>	0.185
$^{45}_{21}\text{Sc}$	<b>1.0398</b>	100
$^{46}_{22}\text{Ti}$	<b>1.0739</b>	7.95
$^{47}_{22}\text{Ti}$	<b>1.0570</b>	7.75

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${}_{22}^{48}\text{Ti}$	<b>1.029</b>	73.45
${}_{22}^{49}\text{Ti}$	<b>1.0081</b>	5.51
${}_{22}^{50}\text{Ti}$	<b>0.9879</b>	5.34
${}_{23}^{50}\text{V}$	<b>1.0548</b>	0.24
${}_{23}^{51}\text{V}$	<b>1.0341</b>	99.76
${}_{24}^{52}\text{Cr}$	1.1273	83.76
${}_{24}^{50}\text{Cr}$	1.1724	4.31
${}_{24}^{53}\text{Cr}$	1.1060	9.55
${}_{24}^{54}\text{Cr}$	<b>1.0855</b>	2.38
${}_{25}^{55}\text{Mn}$	1.113	100
${}_{26}^{54}\text{Fe}$	1.1242	5.84
${}_{26}^{56}\text{Fe}$	<b>1.0841</b>	91.68
${}_{26}^{57}\text{Fe}$	<b>1.0650</b>	2.17
${}_{26}^{58}\text{Fe}$	<b>1.0467</b>	0.31

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$^{59}_{27}\text{Co}$	<b>1.1455</b>	100
$^{60}_{28}\text{Ni}$	<b>1.1337</b>	26.16
$^{61}_{28}\text{Ni}$	1.1151	1.25
$^{58}_{28}\text{Ni}$	1.1728	67.76
$^{62}_{28}\text{Ni}$	<b>1.0971</b>	3.66
$^{64}_{28}\text{Ni}$	<b>1.0688</b>	1.16
$^{63}_{29}\text{Cu}$	1.1491	69.1
$^{65}_{29}\text{Cu}$	1.1138	30.9
$^{67}_{30}\text{Zn}$	1.1495	4.11
$^{68}_{30}\text{Zn}$	<b>1.1326</b>	18.56
$^{66}_{30}\text{Zn}$	1.1669	27.81
$^{70}_{30}\text{Zn}$	1.1002	0.62
$^{64}_{30}\text{Zn}$	<b>1.2034</b>	48.89

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$^{69}_{31}\text{Ga}$	<b>1.1367</b>	60.5
$^{71}_{31}\text{Ga}$	1.1047	39.5
$^{72}_{32}\text{Ge}$	1.1252	27.37
$^{70}_{32}\text{Ge}$	1.1574	20.55
$^{73}_{32}\text{Ge}$	1.1098	7.61
$^{74}_{32}\text{Ge}$	<b>1.0948</b>	36.74
$^{76}_{32}\text{Ge}$	<b>1.0660</b>	7.67
$^{75}_{39}\text{As}$	1.1249	100
$^{77}_{34}\text{Se}$	<b>1.1471</b>	7.58
$^{78}_{34}\text{Se}$	<b>1.1324</b>	23.52
$^{76}_{34}\text{Se}$	1.1622	9.02
$^{80}_{34}\text{Se}$	1.1041	49.82
$^{74}_{34}\text{Se}$	<b>1.1937</b>	0.87
$^{82}_{34}\text{Se}$	<b>1.0772</b>	9.19

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$^{81}_{35}\text{Br}$	<b>1.1460</b>	49.48
$^{79}_{35}\text{Br}$	1.1750	50.52
$^{80}_{36}\text{Kr}$	<b>1.1464</b>	2.27
$^{82}_{36}\text{Kr}$	1.1185	11.56
$^{78}_{36}\text{Kr}$	1.1758	0.35
$^{83}_{36}\text{Kr}$	1.1050	11.55
$^{84}_{36}\text{Kr}$	<b>1.0918</b>	56.9
$^{86}_{36}\text{Kr}$	<b>1.0664</b>	17.37
$^{85}_{37}\text{Rb}$	<b>1.0956</b>	72.15
$^{87}_{37}\text{Rb}$	<b>1.0704</b>	27.85
$^{84}_{38}\text{Sr}$	1.1394	0.56
$^{86}_{38}\text{Sr}$	1.1129	9.86
$^{87}_{38}\text{Sr}$	1.1001	7.02
$^{88}_{38}\text{Sr}$	<b>1.0877</b>	82.56

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$^{89}_{39}\text{Y}$	<b>1.0913</b>	100
$^{90}_{40}\text{Zr}$	1.1079	51.46
$^{91}_{40}\text{Zr}$	<b>1.0958</b>	11.23
$^{92}_{40}\text{Zr}$	<b>1.0838</b>	17.11
$^{94}_{40}\text{Zr}$	<b>1.0607</b>	17.40
$^{93}_{41}\text{Nb}$	1.1230	100
$^{95}_{42}\text{Mo}$	<b>1.1467</b>	15.70
$^{96}_{42}\text{Mo}$	<b>1.1348</b>	16.5
$^{97}_{42}\text{Mo}$	1.1231	9.45
$^{98}_{42}\text{Mo}$	1.1116	23.75
$^{94}_{42}\text{Mo}$	1.1589	9.12
$^{92}_{42}\text{Mo}$	1.1841	15.86
$^{100}_{42}\text{Mo}$	<b>1.0894</b>	9.62
$^{104}_{44}\text{Ru}$	<b>1.1473</b>	18.67

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$^{102}_{44}\text{Ru}$	1.1698	31.52
$^{101}_{44}\text{Ru}$	<b>1.1814</b>	17.01

$^{100}_{44}\text{Ru}$	<b>1.1932</b>	12.69
$^{99}_{44}\text{Ru}$	<b>1.2052</b>	12.70
$^{98}_{44}\text{Ru}$	<b>1.2175</b>	1.91
$^{96}_{44}\text{Ru}$	<b>1.2429</b>	5.50
$^{103}_{45}\text{Rh}$	1.1284	100
$^{108}_{46}\text{Pd}$	<b>1.1420</b>	26.8
$^{110}_{46}\text{Pd}$	1.1212	13.5
$^{106}_{46}\text{Pd}$	1.1636	27.2
$^{105}_{46}\text{Pd}$	1.1746	22.6
$^{104}_{46}\text{Pd}$	<b>1.1859</b>	9.3
$^{102}_{46}\text{Pd}$	<b>1.2092</b>	0.8
$^{109}_{45}\text{Ag}$	<b>1.1445</b>	48.65
$^{107}_{45}\text{Ag}$	1.1659	51.35

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$^{112}_{48}\text{Cd}$	<b>1.1369</b>	24.07
$^{111}_{48}\text{Cd}$	<b>1.1472</b>	12.75
$^{113}_{48}\text{Cd}$	1.1269	12.26
$^{108}_{48}\text{Cd}$	1.1790	0.875
$^{114}_{48}\text{Cd}$	1.1170	28.86
$^{110}_{48}\text{Cd}$	1.1576	12.39
$^{116}_{48}\text{Cd}$	<b>1.0977</b>	7.58
$^{106}_{48}\text{Cd}$	<b>1.2013</b>	1.22

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$^{113}_{49}\text{In}$	1.1394	4.23
$^{115}_{49}\text{In}$	1.1196	95.77
$^{115}_{50}\text{Sn}$	<b>1.1421</b>	0.34
$^{116}_{50}\text{Sn}$	<b>1.1322</b>	14.24
$^{117}_{50}\text{Sn}$	1.1225	7.57
$^{114}_{50}\text{Sn}$	1.1521	0.65
$^{118}_{50}\text{Sn}$	1.1130	24.01
$^{112}_{50}\text{Sn}$	1.1726	0.95
$^{119}_{50}\text{Sn}$	1.1037	8.58
$^{120}_{50}\text{Sn}$	<b>1.0945</b>	32.97
$^{122}_{50}\text{Sn}$	<b>1.0765</b>	4.71
$^{124}_{50}\text{Sn}$	<b>1.0592</b>	5.98
$^{121}_{51}\text{Sb}$	1.1131	57.25
$^{123}_{51}\text{Sb}$	<b>1.0950</b>	42.75
$^{122}_{52}\text{Te}$	<b>1.1365</b>	2.46
$^{123}_{52}\text{Te}$	1.1272	0.87
$^{120}_{52}\text{Te}$	1.1554	0.089

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$^{124}_{52}\text{Te}$	1.1181	4.61
$^{125}_{52}\text{Te}$	1.1092	6.99
$^{126}_{52}\text{Te}$	1.1004	18.71
$^{128}_{52}\text{Te}$	<b>1.0832</b>	31.79
$^{130}_{52}\text{Te}$	<b>1.0665</b>	34.49
$^{127}_{53}\text{I}$	1.1271	100
$^{124}_{54}\text{Xe}$	<b>1.1454</b>	0.096
$^{126}_{54}\text{Xe}$	1.1272	0.09
$^{128}_{54}\text{Xe}$	1.1096	1.92
$^{129}_{54}\text{Xe}$	1.1010	26.44
$^{130}_{54}\text{Xe}$	<b>1.0926</b>	4.08
$^{132}_{54}\text{Xe}$	<b>1.0760</b>	26.89
$^{134}_{54}\text{Xe}$	<b>1.0599</b>	10.44
$^{136}_{54}\text{Xe}$	<b>1.0444</b>	8.87
$^{133}_{55}\text{Cs}$	<b>1.0786</b>	100
$^{130}_{56}\text{Ba}$	1.1233	0.10

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$^{132}_{56}\text{Ba}$	1.1063	0.01
$^{134}_{56}\text{Ba}$	<b>1.0898</b>	2.42
$^{135}_{56}\text{Ba}$	<b>1.0817</b>	6.59
$^{136}_{56}\text{Ba}$	<b>1.0737</b>	7.81
$^{137}_{56}\text{Ba}$	<b>1.0659</b>	11.32
$^{138}_{56}\text{Ba}$	<b>1.0582</b>	71.66
$^{138}_{57}\text{La}$	<b>1.0685</b>	0.09
$^{139}_{57}\text{La}$	<b>1.0608</b>	99.91
$^{136}_{58}\text{Ce}$	1.1032	0.19
$^{138}_{58}\text{Ce}$	<b>1.0872</b>	0.25
$^{140}_{58}\text{Ce}$	<b>1.0717</b>	88.48
$^{142}_{58}\text{Ce}$	<b>1.0566</b>	11.07
$^{141}_{59}\text{Pr}$	<b>1.0878</b>	100
$^{142}_{60}\text{Nd}$	1.1081	27.13
$^{143}_{60}\text{Nd}$	1.1003	12.20
$^{144}_{60}\text{Nd}$	<b>1.0927</b>	23.87

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${}_{60}^{145}\text{Nd}$	<b>1.0852</b>	8.3
${}_{60}^{146}\text{Nd}$	<b>1.0777</b>	17.18
${}_{60}^{148}\text{Nd}$	<b>1.0632</b>	5.72
${}_{60}^{150}\text{Nd}$	<b>1.0490</b>	5.60
${}_{62}^{144}\text{Sm}$	1.1162	3.16
${}_{62}^{147}\text{Sm}$	<b>1.0934</b>	15.07
${}_{62}^{148}\text{Sm}$	<b>1.0860</b>	11.27
${}_{62}^{149}\text{Sm}$	<b>1.0787</b>	13.84
${}_{62}^{150}\text{Sm}$	<b>1.0715</b>	7.47
${}_{62}^{152}\text{Sm}$	<b>1.0574</b>	26.63
${}_{62}^{154}\text{Sm}$	<b>1.0437</b>	22.53
${}_{63}^{151}\text{Eu}$	<b>1.1406</b>	47.77
${}_{63}^{153}\text{Eu}$	1.1257	52.23
${}_{64}^{152}\text{Gd}$	<b>1.1424</b>	0.20
${}_{64}^{154}\text{Gd}$	1.1275	2.15
${}_{64}^{155}\text{Gd}$	1.1203	14.73
${}_{64}^{156}\text{Gd}$	1.1131	20.47

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$^{157}_{64}Gd$	1.1060	15.68
$^{158}_{64}Gd$	<b>1.0990</b>	24.87
$^{160}_{64}Gd$	<b>1.0852</b>	21.90
$^{159}_{65}Tb$	<b>1.0696</b>	100
$^{163}_{66}Dy$	<b>1.1388</b>	24.97
$^{162}_{66}Dy$	<b>1.1459</b>	25.53
$^{164}_{66}Dy$	<b>1.1319</b>	28.18
$^{161}_{66}Dy$	1.1530	18.88
$^{160}_{66}Dy$	1.1602	2.3
$^{158}_{66}Dy$	1.1749	0.09
$^{156}_{66}Dy$	<b>1.1900</b>	0.05
$^{165}_{67}Ho$	<b>1.0853</b>	100
$^{170}_{68}Er$	1.1708	14.88
$^{168}_{68}Er$	<b>1.1848</b>	27.07
$^{167}_{68}Er$	<b>1.1919</b>	22.94
$^{166}_{68}Er$	<b>1.990</b>	33.41

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${}^{164}_{68}\text{Er}$	<b>1.2137</b>	1.56
${}^{162}_{68}\text{Er}$	<b>1.2287</b>	0.14
${}^{169}_{68}\text{Tm}$	<b>1.2563</b>	100
${}^{174}_{70}\text{Yb}$	<b>1.1403</b>	31.84
${}^{173}_{70}\text{Yb}$	<b>1.1469</b>	16.13
${}^{176}_{70}\text{Yb}$	1.1274	12.73
${}^{172}_{70}\text{Yb}$	1.1536	21.82
${}^{171}_{70}\text{Yb}$	1.1603	14.31
${}^{170}_{70}\text{Yb}$	1.1672	3.03
${}^{168}_{70}\text{Yb}$	<b>1.1811</b>	0.14
${}^{175}_{71}\text{Lu}$	<b>1.1419</b>	97.40
${}^{176}_{71}\text{Lu}$	<b>1.1354</b>	2.60
${}^{178}_{72}\text{Hf}$	<b>1.1372</b>	27.23
${}^{177}_{72}\text{Hf}$	<b>1.1436</b>	18.55
${}^{179}_{72}\text{Hf}$	1.1308	13.73
${}^{180}_{72}\text{Hf}$	1.1245	35.07

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$^{176}_{72}\text{Hf}$	1.1501	5.23
$^{174}_{72}\text{Hf}$	1.1633	0.2
$^{181}_{73}\text{Ta}$	<b>1.1368</b>	99.99
$^{180}_{73}\text{Ta}$	<b>1.1431</b>	0.01
$^{182}_{74}\text{W}$	<b>1.1342</b>	26.4
$^{180}_{74}\text{W}$	<b>1.1468</b>	0.135
$^{183}_{74}\text{W}$	1.1280	14.4
$^{184}_{74}\text{W}$	1.1218	30.6
$^{186}_{74}\text{W}$	<b>1.1098</b>	28.4
$^{187}_{75}\text{Re}$	<b>1.1456</b>	62.93
$^{185}_{75}\text{Re}$	1.1580	37.07
$^{187}_{76}\text{Os}$	<b>1.1396</b>	1.64
$^{186}_{76}\text{Os}$	<b>1.1458</b>	1.59
$^{188}_{76}\text{Os}$	<b>1.1336</b>	13.3
$^{189}_{76}\text{Os}$	1.1276	16.1
$^{184}_{76}\text{Os}$	1.1582	0.02

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$^{190}_{76}\text{Os}$	1.1216	26.4
$^{192}_{76}\text{Os}$	1.1100	41.0
$^{193}_{77}\text{Ir}$	1.1638	61.5
$^{191}_{77}\text{Ir}$	1.1760	38.5
$^{198}_{78}\text{Pt}$	<b>1.1819</b>	7.23
$^{196}_{78}\text{Pt}$	<b>1.1940</b>	25.4
$^{195}_{78}\text{Pt}$	<b>1.2000</b>	33.7
$^{194}_{78}\text{Pt}$	<b>1.2063</b>	32.8
$^{192}_{78}\text{Pt}$	<b>1.2188</b>	0.78
$^{190}_{78}\text{Pt}$	<b>1.2317</b>	0.01
$^{197}_{79}\text{Au}$	1.1546	100
$^{202}_{80}\text{Hg}$	<b>1.1388</b>	29.80
$^{201}_{80}\text{Hg}$	<b>1.1444</b>	13.22
$^{200}_{80}\text{Hg}$	1.1502	23.13
$^{204}_{80}\text{Hg}$	1.1276	6.85
$^{199}_{80}\text{Hg}$	1.1560	16.84

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$^{198}_{80}\text{Hg}$	1.1618	10.02
$^{196}_{80}\text{Hg}$	1.1737	0.15
$^{203}_{81}\text{Tl}$	<b>1.1402</b>	29.50
$^{205}_{81}\text{Tl}$	1.1290	70.50
$^{206}_{82}\text{Pb}$	<b>1.1361</b>	23.6
$^{207}_{82}\text{Pb}$	1.1306	22.6
$^{204}_{82}\text{Pb}$	1.1473	1.48
$^{208}_{82}\text{Pb}$	1.1252	52.3

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${}_{83}^{209}\text{Bi}$	<b>1.1358</b>	100
${}_{90}^{232}\text{Th}$	<b>1.0894</b>	100
${}_{92}^{234}\text{U}$	1.1004	0.006
${}_{92}^{235}\text{U}$	<b>1.0957</b>	0.72
${}_{92}^{238}\text{U}$	<b>1.0819</b>	99.28

### 10.2 THE HYDROGEN AND NICKEL EXPERIMENTS

Several laboratories around the world (you may easily search the internet for the pioneers of Low-Energy Nuclear Reactions) claimed, rightly or not, that they can fuse nickel and hydrogen atoms into copper as a final product. Read NASA's claims that cold fusion technology could put a nuclear reactor in every home, car, and plane (<http://www.extremetech.com/extreme/149090-nasas-cold-fusion-tech-could-put-a-nuclear-reactor-in-every-home-car-and-plane>). Unfortunately, none of them are capable of understanding the reason for their findings in an unambiguous way and, therefore, give a clear, and attractive explanation to the scientific community; such a shortfall is considered as a cardinal sin in science; or is it? One thing is sure: without a logical explanation for a phenomenon taking place, patents should not be granted or valid. But, as Albert Einstein suggested

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many times, without audacious speculations to achieve substantial progress in science, there is nothing new at the end of the road. So, please forgive the imperfections of those who, with their deep vision, dare drive new roads; we should guide them to polish their findings instead of finding details where they can be unfairly ostracized.

Now, let's look at the  $\frac{x^3}{y}$  ratios of the naturally occurring isotopes of these metals.

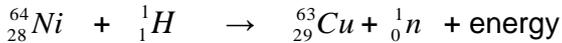
Isotopes  $^{62}\text{Ni}$  and  $^{64}\text{Ni}$  are excellent recipients with ratios 1.0971 and 1.0688 respectively and natural abundance at 3.66% and 1.16%, respectively. Furthermore,  $^{58}\text{Ni}$ , with a ratio of 1.1728, is not a bad recipient with a natural abundance of 69.1%. On the other hand,  $^{60}\text{Ni}$  would be a very unlikely recipient with a ratio of 1.1337.

Many scientists today would deny that nuclear reactions can take place without using powerful beams, almost like destroying the beautiful cathedral with a canon, so they can learn how it was built by analyzing the rubble. Throughout this book, using the Theory of Vacuoles, we suggest that nuclei may not be the inaccessible fortresses as what many scientists believe. Subtle, well-balanced, well-presented beams of photons, particles such as protons from lithium

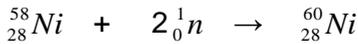
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hydrides, electrons, positrons, neutrons, and mysterious neutrinos may be sufficient to open the doors to new worlds. Remember, the Theory of Vacuoles suggests that assemblages of vacuoles (i.e., nuclei) are happy clubs who would welcome anyone if presented in attractive, irresistible ways to reach ideal stability.

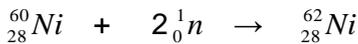
Isotope  $^{63}\text{Cu}$ , with a ratio 1.1491 and a natural abundance of 69.1%, can be described as a good final product. The reaction may therefore be written as follows:



$^{58}\text{Ni}$  does not appear to participate in these reactions; however,  $^{60}\text{Ni}$ , with a ratio of 1.1337 would be an excellent final product, so  $^{58}\text{Ni}$  may capture produced neutrons to give  $^{60}\text{Ni}$ .



Perhaps, it may go an extra step according to some experimenters, though this is very unlikely since  $^{60}\text{Ni}$  is far more stable than  $^{62}\text{Ni}$ :



So far, the conclusion is that the production of energy seems to result mainly from  $^{64}\text{Ni}$ , which is not abundant in nature. However, produced neutrons may

indeed trigger other reactions, which may explain observations from experimenters: the possibilities may be many and the production of  $^{60}\text{Ni}$  is only one option.

Of course, there are other factors involved, such as, the fact that nickel powder may store large amounts of protons, initial heat may have played an important role, which other stimuli researchers may find. Also, if nickel is mixed with other likely recipients such as  $^{41}\text{K}$ , that can deliver  $^{40}\text{Ca}$  and plenty of neutrons, as shown in the next section, then new possibilities for nickel may indeed open up.

### **10.3 SOLVING THE MYSTERY OF THE CHICKEN**

A long time ago when I was working for the French Atomic Energy Commission in Fontenay aux Roses, near Paris, we often told the joke about experimenters who found out that a hen, completely deprived of calcium in her diet, but well-supplied with potassium, would continue to make eggs with thick shells rich in calcium. Findings from these experimenters were completely rejected from the most orthodox scientists and, yet, many of us would wonder if, perhaps, there are indeed things in nature we don't fully understand. That doubt stayed with me for many years, until today. For the reader interested about more background on experiments involving chicken making eggs with calcium-rich shells when there

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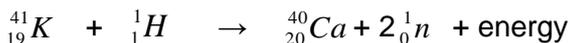
is no calcium at all in their diet, refer to the work of the French professor C.L. Kervran<sup>52,53</sup>; these experiments are well documented and not new.

Basically, the conclusion was that chicken are capable to transform potassium into calcium when absolutely necessary.

So, let's repeat our analysis with the  $\frac{x^{\frac{3}{2}}}{y}$  ratio of the naturally occurring isotopes of potassium and calcium.

Isotope  $^{41}\text{K}$  is an excellent recipient with a ratio of 1.0744 and a natural abundance at 6.73%.

Isotope  $^{40}\text{Ca}$ , with a ratio 1.1348 and a natural abundance at 96.97%, can be described as an excellent, very stable final product; nature loves stability. The reaction may therefore be written as follows:



This is a lot of energy and the potential emission of neutrons, which is not a common occurrence, may open the door to many secondary possibilities. This natural reaction may indeed work like a charm, and in this process keep the chicken quite warm in winter. This may apply to all birds in nature. I always wondered why, with our massive bodies at 37°C, we struggle so much to stay warm in winter, while a tiny sparrow, weighing a few grams with a body

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temperature of 40°C, has no problem at all of staying alive in temperatures below -30°C in rough winters. Think about it, with such a tiny body mass, it should not take many hours for that bird to become frozen hard many times over. Now, it is my opinion we have the explanation. If the bird can perform such transmutation to make eggs, it probably can do the same thing to stay warm.

It is my opinion that, because this experiment has been performed and its results confirmed by so many people around the world, we should conclude that our model with the Theory of Vacuoles is indeed correct, qualitatively, and quantitatively. Of course, the stimulus to activate the reaction is still a mystery; let's have no illusion about this, but it is not a reason to reject the results from these experiments<sup>54</sup>. Going back to my old course notes on Agriculture Chemistry, I would strongly suggest more research should be done on enzymes, such as “hydrogenase” in chicken livers and gizzards. Furthermore, it is well known the presence of potassium ions can greatly activate enzymes. To keep our humor alive I suddenly have far more respect for that peaceful chicken!

### **10.4 THE AWESOME POWER OF FOREST MYCELIUM**

As suggested by Paul Stamets<sup>51</sup>, mushrooms can munch rocks. Mycelium has the surprising ability to break through very hard rocks such as granite, and do it fast. The process creates micron-size cavities where water can effectively start

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the weathering process of transporting valuable mineral constituents to the soil. To do this, a staggering amount of pressure must be applied at the micron-size tip of mycelium that can hardly be explained by any chemical process we know. There is no doubt that the many minerals comprising granite, such as quartz, feldspar, mica, amphibole, pyroxene, zircon, apatite, magnetite, and many others must present opportunities with many weakly stable isotopes to transmute into more stable ones by simple proton capture. It is possible that mycelium found the proper stimuli a long time ago needed to trigger the weathering processes so important for biological life to prosper. This subject alone should be ideal ground for Ph.D. geology students to perform valuable research. The way mycelium acts is effective, calculated, and basically nothing can resist such a fascinating and fundamental form of intelligence. Actually, it is very likely that mycelium already exist in comets, therefore Europa, Enceladus, Ganymene, Callisto and many more that were generated by comets over the billion years. Furthermore, it is very likely life cannot exist without mycelium organizing that wonderful enzymatic dance.

## 10.5 THE CARBON AND SILICON ALLIANCE

Common knowledge shows that the universe is made of two formidable worlds, one is the world of carbon and its biological network, the other one is the world of silicon and its geochemical network. Both elements carbon and silicon have a lot in common as indicated in the periodic table as suggested long ago by Julius Lothar Meyer and Dmitri Mendeleef. Ever since, we have explored the worlds of carbon and silicon as if they were two different, very different foundations for life in the universe, which are biological life and mineral life. We also well know about the formidable network of structures these elements can produce within nature, as they are a far more advanced version of our "internet."

Now, our little incursion into the world of mycelium (i.e., carbon and water) borrowing nutrients from the world of silicon (e.g., granite) may actually suggest some sort of alliance between these worlds out of evolutionary necessity. Don't forget, the universal background, the only thing there is, is at work through universal entanglement, which therefore decides how it will find the proper stimuli in a deterministic way.

Let's go back to the possibilities listed in table 10-1. We should direct our attention to naturally occurring isotopes that may not necessarily be the most abundant in nature, but, on the other hand, they certainly offer possibilities, both for the world of carbon and for the world of silicon. These isotopes are  $^{13}\text{C}$

## The Theory of Vacuoles and LENR

(1.0877 unstable ratio and an abundance of 1%) and  $^{30}\text{Si}$  (1.023 very unstable ratio and an abundance of 3.1%). Even isotope  $^{29}\text{Si}$  (1.058 unstable ratio and an abundance of 4.7%) may also be an attractive candidate. The following possible transmutation into a new isotope  $^{40}\text{Ca}$  (1.1348 ratio, super stable) needed everywhere in nature, is where both world may meet in a powerful way. The small abundance of the isotopes should not be a problem.



So, not only would this possible transmutation create a needed new isotope in nature, but would also create a lot of energy and, open doors in both worlds of carbon and silicon to find the many nutrients they need in their respective networks. If anyone told me that, with a super stable isotope produced at the end of this reaction, nature did not find the proper stimuli to trigger the reaction, I would have a serious problem believing such a thing; mycelium did it, and does it all the time! So, the creation of calcium breaks the mineral, and the inevitable weathering starts its well-known mission. By the way, with so much energy available, perhaps life does not necessarily need sunlight to evolve, especially with neutrinos all over the place, the deterministic role of which, is still a mystery. The conclusion is that we have vastly underestimated the importance of fungi to create and sustain life and its environment. Perhaps, it would be

## The Theory of Vacuoles and LENR

appropriate to define what the mission of an enzyme is for the reader. In nature, many substances must be stable for the survival of animal and vegetal forms; enzymes are substances that are capable of destabilizing them at the right place and the right time in order to produce energy or other constituents. Basically, we are talking about intelligent acts, like it or not. Eventually, we will teach our internet to communicate with those far more advanced internets of carbon, silicon and fungi which will be a fascinating time indeed.

Assuming we can figure out the possibilities of fusing carbon and silicon as suggested above, then we may also look at the possibilities of fusing isotopes  $^{12}\text{C}$  (1.1785 slightly unstable ratio and an abundance of 98.89%) and  $^{28}\text{Si}$  (1.207 unstable ratio and an abundance of 92.3%). The following possible transmutation into a new isotope  $^{40}\text{Ca}$  (1.1348 ratio, super stable) is where both worlds may meet in another powerful way.



It is not farfetched that such a possibility, assuming we could find the appropriate stimuli, would lead to an effective process to eliminate carbon dioxide emissions so harmful and a concern for global warming.

## **10.6 BIOLOGICAL AND MINERAL TRANSMUTATIONS**

These chicken and mycelium examples are only small appetizers. The Theory of Vacuoles clearly says everything in nature is “One” and universal entanglement is a structural property of the Universe. Then, it is not farfetched to believe that nature learned some key mechanisms involving biochemistry and nuclei transmutation a long time ago, billions of years before we evolved with our slide rules and computers. Therefore, it would be expected that, in nature, we may find plenty of intriguing examples that would help us to better comprehend Low-Energy Nuclear Reactions, if we are willing to open our mind to new ideas, just a little.

It is our view that a more profound understanding of biological transmutation possibilities has stunning implications for progress in science, health, medicine, preventive action against cancer, agriculture, and food supplies around the world. The cost of such research is nothing when compared with what we are willing to pay for wars to kill one another.

Albert Einstein said once “there is something in each of us that nobody knows.” We are “One,” there is universal entanglement, and there is an universal medium making up everything we know. This is worthwhile a few more words later on in part 4.

### Likely recipients of protons

Table 10-1 can be used to suggest the likely good combinations between weak recipients and stable products when making attempts to inject a proton. Ratios

$\frac{x^{\frac{3}{2}}}{y}$  and natural abundance are indicated in parentheses.

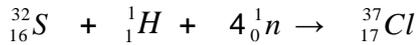
$^{19}\text{F}$  (1.253, 100%) giving  $^{20}\text{Ne}$  (1.1347, 90.92%):



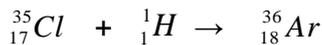
$^{36}\text{S}$  (1.0558, 0.016) giving  $^{37}\text{Cl}$  (1.1488, 24.6%):



$^{32}\text{S}$  (1.187, 95.1%) giving  $^{37}\text{Cl}$  (1.1488, 24.6%):



$^{37}\text{Cl}$  (1.214, 75.4%) giving  $^{36}\text{Ar}$  (1.1498, 0.34%):



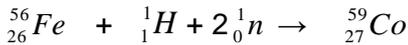
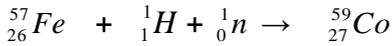
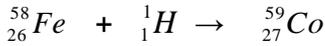
$^{51}\text{V}$  (1.0341, 99.76%) giving  $^{52}\text{Cr}$  (1.1273, 83.76%):



Possibilities with iron, cobalt, and nickel seem to be many. Iron has three attractive recipients,  $^{56}\text{Fe}$  (1.0841, 91.68%),  $^{57}\text{Fe}$  (1.0650, 2.17%), and  $^{58}\text{Fe}$

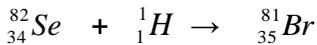
## The Theory of Vacuoles and LENR

(1.0467, 0.31%), immediately followed by two excellent final products such as  $^{59}\text{Co}$  and  $^{60}\text{Ni}$ .

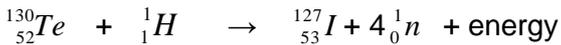


The trail from iron isotopes to  $^{60}\text{Ni}$  may involve several protons and neutrons or  ${}^4\text{He}$ .

$^{82}\text{Se}$  (1.0772, 9.19%) giving  $^{81}\text{Br}$  (1.1460, 49.48%)



$^{130}\text{Te}$  (1.0665, 34.49%) giving  $^{127}\text{I}$  (1.1271, 100%)



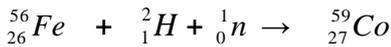
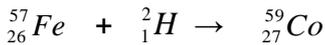
This is another example where neutrons can be produced and used for secondary nuclear reactions. Tellurium is a rare element often found in association with gold, copper, and nickel. We could find a few more possibilities using table 10.1.

You may notice proton vacuoles are used in these reactions and we know that charged vacuoles may not be the best projectiles to catalyze these reactions.

What if deuterons  ${}_1^2\text{H}$  were used as projectiles? The neutron of the deuteron

## The Theory of Vacuoles and LENR

has no problem approaching the nuclei of the target, while the proton is likely to be rejected by the target. However, the neutron may decay inside the target nuclei as a proton and an electron or beta radiation. It seems that all the above reactions would be easy to take place. The following examples are among many possibilities.



However, the following reaction, as suggested in the literature, with  ${}^{55}\text{Mn}$  (ratio 1.113) producing  ${}^{57}\text{Fe}$  (ratio 1.0650) is very unlikely:



Ionic hydrides may provide a convenient source of active hydrogen (protons) for these reactions.

### Review of combined other elements as likely recipients

Biological transmutation literature from various authors and especially C. Louis Kervran<sup>52,53</sup> suggests natural transmutations from  ${}^{24}\text{Mg}$  and  ${}^{16}\text{O}$  into  ${}^{40}\text{Ca}$ , and another one, with  ${}^{28}\text{Si}$  and  ${}^{12}\text{C}$  into  ${}^{40}\text{Ca}$ . Let's analyze these possibilities using table 10.1.

## The Theory of Vacuoles and LENR

Recipients  $^{24}\text{Mg}$  (1.112) and  $^{16}\text{O}$  (1.207) giving the final product  $^{40}\text{Ca}$  (1.1348) are unlikely to succeed, however, recipients  $^{25}\text{Mg}$  (1.068) and  $^{16}\text{O}$  (1.207), giving the final product  $^{40}\text{Ca}$  (1.1348), are much more likely to succeed.

Recipients  $^{28}\text{Si}$  (1.096) and  $^{12}\text{C}$  (1.1785), giving the final product  $^{40}\text{Ca}$  (1.1348), are unlikely to succeed, however, recipients  $^{29}\text{Si}$  (1.058) and  $^{13}\text{C}$  (1.0877), giving the final product  $^{40}\text{Ca}$  (1.1348), are much more likely to succeed.

I cannot emphasize strongly enough the implications of these two examples for human health and diet.

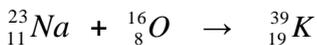
Another possibility would be  $^{23}\text{Na}$  (1.048) reacting with  $^{31}\text{P}$  (1.098), giving a more stable isotope such as  $^{54}\text{Fe}$  (1.1242).

Perhaps, we should recall the fusion of deuterium and tritium into helium activated with a simple laser is a current technology being done; the emission of a powerful neutron beam is then used for neutron activation to enable on-line analyzers to read the prompt gamma emissions for many elements. In other words, we already apply somewhat Low-Energy Nuclear Reactions in some domains of the industry and it should not come as a surprise that we may learn a lot more very soon.

### Sodium and oxygen alliance

Some past experiments or observations are so compelling that I find it inappropriate to deny the conclusions of these bright scientists. Two examples, among many, are worth mentioning. The French scientist Perrault, according to R.A. Nelson<sup>55</sup>, proved that the hormone aldosterone provoked a transmutation of sodium to potassium that can be fatal to a patient. Also, another French scientist Julien<sup>56</sup> from Besançon University, in 1959, proved that some fish like tench, when confined in a water tank containing 14% sodium chloride, increased their production of potassium chloride by 36% within 4 hours.

So, let's go back to the possibilities listed in table 10-1. With isotopes  ${}_{11}^{23}\text{Na}$  (1.048 unstable ratio and an abundance of 100%) and  ${}_{8}^{16}\text{O}$  (1.207 unstable ratio and an abundance of 99.76%) the following transmutation into a new isotope  ${}_{19}^{39}\text{K}$  (1.1295 ratio, far more stable) is possible.



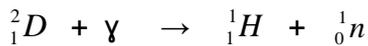
These two examples were selected because they are relatively easy to repeat and also may lead to a better knowledge of appropriate biological stimuli.

### **A need for massive research on stimuli rather than brutal heat**

Research on stimuli and weak reactions, rather than heat, may be extremely rewarding on the long run. Fascinating possibilities may arise, especially if we look carefully at what nature is already doing. We may, indeed, create well-targeted and capable enzymes (proteins) of our own. In this process we may also find new avenues to treat or prevent cancer.

### **Indirect ways into nuclei: bypassing the Coulomb barrier**

These are my speculative thoughts: I am sure they are worth investigating. First, let's recall the interesting property of a Deuteron, as illustrated in figure 10.2; basically, it is the Oppenheimer reaction:



If the Deuteron is used as a projectile to another nucleus or relatively unstable assemblage of vacuoles then, under some conditions, such as using energetic gamma rays, the neutron inside the Deuteron may evaporate and easily enter the targeted nucleus. Of course, the positively charged proton will be rejected by the Coulomb barrier. It is my view that nature created enzymes to replace the energetic gamma ray as needed. It is not impossible that a hydrogenase

## The Theory of Vacuoles and LENR

enzyme could indeed take advantage of the tiny amount of Deuterium present in the environment.

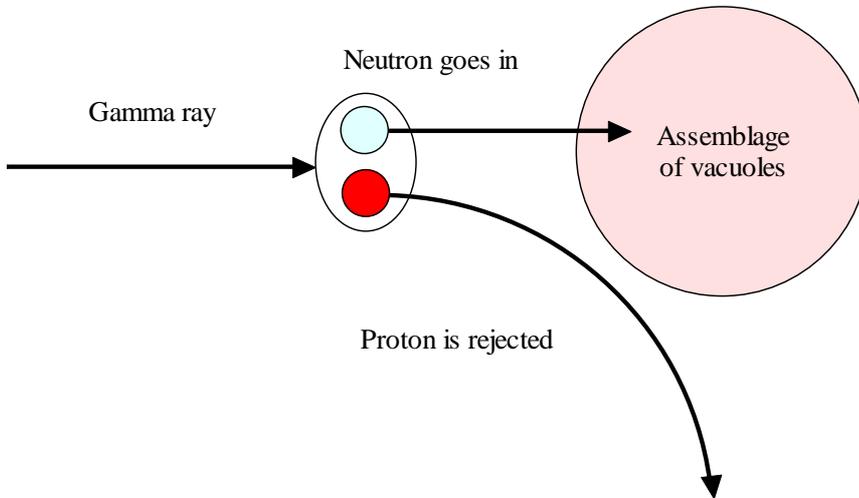


Figure 10.2. Oppenheimer's reaction

Now that we have a neutron inside a targeted nucleus, the nucleus is obviously excited and several scenarios may take place:

**Scenario #1:** If the targeted recipient is the nickel isotope  ${}^{60}_{28}\text{Ni}$ , with a stable

ratio  $\frac{x^3}{y}$  of 1.1337, leading to another nickel isotope  ${}^{61}_{28}\text{Ni}$ , also having a stable

ratio of 1.1151, nothing may happen except that there may be a decreased amount of the light isotope and an increased amount of the heavier isotope.

**Scenario #2:** However, going back to the mystery of our chicken, if the targeted isotope is  ${}^{41}_{19}\text{K}$  with an already unstable ratio of 1.0744, an additional neutron is not welcome, therefore the neutron may simply be forced to decay into an additional proton and emit an electron that will exit the nucleus, as suggested in figure 10.3. The proton does not have to break the Coulomb Barrier since it is born in-situ... Born in-situ may be the key of everything.

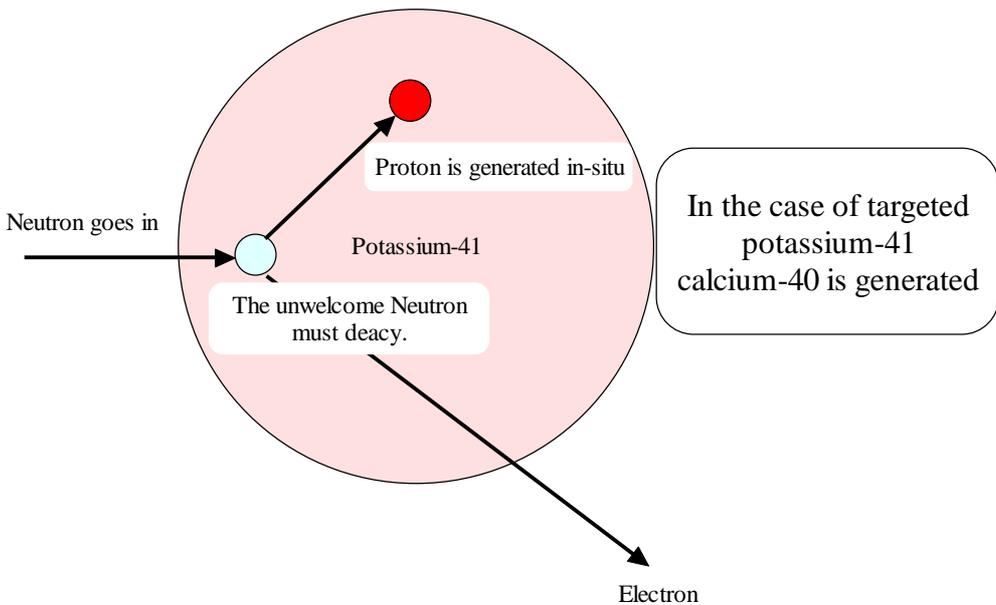
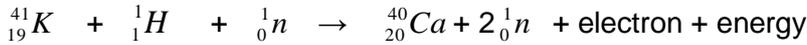


Figure 10.3. An unwelcome neutron must decay in situ.

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Then, the following reaction can and will take place.



The question is, with appropriate stimuli, how many cases like this one may exist in nature, making it a priceless source of opportunities for us to grab?

These examples illustrate the importance of taking into account the value of the

$\frac{x^{\frac{3}{2}}}{y}$  ratio in a dramatic way.

### 10.7 THE CASE OF MERCURY IN COMPACT FLUORESCENT BULBS

Compact fluorescent bulbs are low pressure mercury-vapor gas-discharge bulbs that use fluorescence to light our homes. When an electric current is passed through the mercury gas, the mercury atoms become excited and generate ultraviolet light which reacts with the phosphorus coating inside the bulb to make the bulb glow.

According to an article written by Jeff MacMahon – Follow on Forbes (239) – the proportion of mercury isotopes used in CFL bulbs does not match the normal proportion of mercury isotopes found in nature.

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By looking at the mercury isotopes listed in table 10.1 we see that isotope  $^{198}_{80}\text{Hg}$

, with a  $\frac{x^{\frac{3}{2}}}{y}$  ratio of 1.1618. is somewhat unstable, and isotope  $^{196}_{80}\text{Hg}$  , with a

ratio of 1.1737, which is indeed unstable, suggests that they could become ready recipients of additional neutrons to increase the natural proportion of very

stable mercury isotopes  $^{201}_{80}\text{Hg}$  , with a ratio of 1.1444, and  $^{202}_{80}\text{Hg}$  , with a ratio of

1.1388. The question is: where are the extra neutrons coming from? We could

speculate that the interaction of short wave ultraviolet light with neutrinos may

have something to do with this anomaly.

### 10.8 LITHIUM BATTERIES CATCHING ON FIRE

There are many well-known cases of lithium batteries becoming over heated or even catching on fire; manufacturers do not have a clear chemically-based

explanation. It is possible that there are no chemical explanations; but, instead,

there may be low-energy nuclear reactions taking place. These are the facts

from table 10-1: lithium is made of two natural isotopes, both with very unstable

ratios  $\frac{x^{\frac{3}{2}}}{y}$  .

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${}^6_3\text{Li}$  has an unstable ratio of 1.22 and,  ${}^7_3\text{Li}$  has a ratio of 1.05; these are unfortunate properties, at the very opposite ends of the spectrum suggested by table 10-1 that can open the door to unexpected and unwelcome LENRs.

Some lithium batteries contain iron ions. Iron has two natural isotopes that are very unstable,  ${}^{58}_{26}\text{Fe}$ , with a ratio of 1.0467 and,  ${}^{57}_{26}\text{Fe}$ , with a ratio of 1.0650: these two isotopes are the perfect marriage with lithium  ${}^6_3\text{Li}$ . Even  ${}^7_3\text{Li}$  is highly suspicious and could trigger other combinations to be investigated.

The following reactions may take place:



You may notice, according to table 10-1, the copper end product has a very

stable  $\frac{x^{\frac{3}{2}}}{y}$  ratio of 1.1491: what an unfortunate and dangerous combination

when two very unstable natural isotopes from different ends of the spectrum can get together and produce a very stable isotope.

## The Theory of Vacuoles and LENR

I am sure there are other permutations possible for lithium isotopic reactions. The possibilities are with phosphorus, titanium, and nickel that may be present in lithium batteries.

${}_{15}^{31}P$  with a 100% natural frequency and a  $\frac{x^{\frac{3}{2}}}{y}$  ratio of 1.098 could lead to the

following LENR reaction:



${}_{18}^{36}Ar$  having a very stable ratio of 1.1498 is definitely an invitation for such a reaction to take place and, of course, the stimuli required are not clear yet; it could be heat, gamma radiation, neutrinos, or a combination of all of them.

${}_{22}^{50}Ti$  with a 5.3% natural occurrence and a  $\frac{x^{\frac{3}{2}}}{y}$  ratio of 0.9879 could lead to the

following LENR reaction:



${}_{25}^{55}Mn$  having a moderately stable ratio of 1.113 is not likely to be a candidate because the ratio of  ${}_{22}^{50}Ti$  is so low that it may indeed make a huge difference.

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Also,  ${}_{28}^{64}\text{Ni}$  with a 1.16% natural occurrence and a  $\frac{x^{\frac{3}{2}}}{y}$  ratio of 1.069 could lead

to the following LENR reaction:



${}_{31}^{69}\text{Ga}$  having a very stable ratio of 1.1367, this reaction is a likely candidate. The 1.16% small occurrence of  ${}_{28}^{64}\text{Ni}$  would seem a deterrent, but for LENR this is a very substantial amount.

Other elements present in lithium batteries such as B, C, O, and Co do not seem to present any serious possibilities.

Some lithium batteries contain cobalt. Cobalt has only one natural, very stable isotope with a ratio of 1.1455, therefore, a reaction with cobalt is impossible.

Natural and manmade combinations of lithium isotopes with other elements' isotopes may inadvertently be brought together with unfortunate results, as few people know anything about LENRs. This being said, the good thing is that, to date, when such accidents take place, the LENRs have occurred in non-optimized environments. Nevertheless, as shown by above equations, it does not take many events to liberate a lot of energy.

Perhaps, knowing and understanding LENRs, such unfortunate events could be turned around; it is possible that lithium may lead to fascinating research and stunning new applications... but, we have to change our paradigm first.

A last word regarding the stimuli required to trigger such reactions may be complex and difficult to understand, as it is not heat, gamma rays, or neutrinos, but most likely the combination of all, happening when the place and time are right. This may explain the apparent, statistically erratic reproducibility of such events.

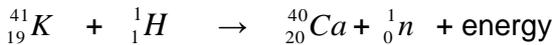
## **10.9 GAMMA RAYS CREATING ELECTRONS AND POSITRONS INSIDE NUCLEI**

There is a huge difference between trying to push a proton through the Coulomb barrier, and a high energy Gamma ray penetrating a nucleus and giving birth to an electron and a positron, in-situ. The former requires enormous energy and this is common knowledge; but, the latter maybe easy to do, though it is not so well understood.

Let's imagine that one electron and one positron are simultaneously created inside the nucleus. We easily demonstrated earlier that the mass of particles may depend on how and where we look at them. In-situ, the positron may very

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well be a proton. The nucleus being excited with the presence of new vacuoles where they may not belong, new nuclear rearrangements become possible, and nature will always select the most stable arrangement possible. In the following reaction the possible scenario is:



1. A Gamma ray gives birth to one electron and one positron simultaneously, **within** the  ${}_{19}^{41}K$  nucleus.
2. The electron reacts with one proton to give one neutron.
3. The positron, now a proton, maintains the atomic weight of 19.
4. Then, within the nucleus there are two neutrons too many, one decays into one proton and an electron, and one is ejected from the nucleus, and very stable  ${}_{20}^{40}Ca$  is created... remember, nature loves stability.

All along, there was no need to challenge the Coulomb barrier.

### **10.10 NEUTRINOS: A STUNNING, UNIVERSAL RESOURCE AT OUR DISPOSAL**

One hundred trillions neutrinos go through our body every second, not causing any interaction, nor any damage; this alone is food for thought. Assuming the mass of neutrinos is extremely small, it would suggest that they are extremely

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small vacuoles as well, and they are made of a well-balanced mix of positive and negative charges. Then, it does not take a lot of imagination to conclude that they may be a structural property of *Ether*, our universal background medium. Furthermore, we know neutrinos have adaptive personalities, which in that case may lead to the preparation of larger packages of vacuoles either charged positively, or negatively, or well-balanced and neutral. We start seeing the importance of neutrinos in low-energy nuclear reactions, but the problem is that we don't know enough about neutrinos yet. However, what is obvious is that neutrinos are an unimaginable resource throughout the entire Universe waiting to be tapped. This is what we are made of, with hundred trillions of tiny vacuoles floating around every second of our life, waiting for a mission of some kind... We don't understand it yet, but the time should come, with the Theory of Vacuoles, when many opportunities will open up.

Then, in the meantime why not speculate! Along its trajectory a Gamma ray may hit billions of neutrino vacuoles, making them fuse to one another, like a long string. Then, and this is where things become weird, these strings break at a pre-programmed length, so they lead to pairs of electron and positron. Finally, each string slowly evolves to a spherical, stable vacuole. There, we see that the theory of the famous astronomer Fred Hoyle is alive and well, and so the String Theory.

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The conclusion is that we could develop a technology to create any stable atom as we wish and where we wish... food for thought!

## **10.11 CORRELATION BETWEEN ISOTOPE STABILITY AND ISOTOPE ABUNDANCE**

Logic would suggest that the most abundant isotopes should be the ones with

the most stable ratios  $\frac{x^{\frac{3}{2}}}{y}$ . But, a quick inspection of table 10.1 reveals that,

very often, this is not the case. The explanation may be very complex, as over geological ages, nature may have used some of these isotopes, which greatly affected their abundance. It is certainly an interesting observation worth speculating about in the future.

## **10.12 THE OPORTUNITY FOR RADIOACTIVE WASTES**

The treatment of existing nuclear waste immediately comes to mind. If transmutations of existing natural isotopes is possible, then transmutations of dangerous radionuclides in nuclear waste must be relatively easy, as the target is obviously very unstable. This should be an urgent research program to promote, instead of spending billions of dollars on vitrification technology to store forever these dangerous wastes. Actually, existing nuclear wastes, if properly managed, can be an awesome source of power using Low-Energy

Nuclear Reactions, the products of which can be made far less hazardous as the product nearly always results into a far more stable isotope.

### **10.13 SOCIAL CONSEQUENCES**

There is absolutely no possible doubt that Low-Energy Nuclear Reactions are much easier to trigger than originally thought. Work in this domain, so far, is barely the tip of the iceberg. To put it bluntly, it is easy to see an industrial revolution taking shape, the consequences of which are nearly impossible to predict. This revolution is inescapable, in the sense that if big oil companies, coal companies, chemical companies, standard nuclear energy producers, and even companies making huge investments in solar and wind power make attempts to stop this new technology, powerful countries will simply waste time and opportunities, and little countries will make awesome breakthroughs. The message for these huge companies is very obvious, either start investing in Low-Energy Nuclear Reactions technologies or you will die; it is just a matter of time. So, yes, by all means, it creates massive political problems, therefore speed and commitments are of the essence. When we see what is happening in the American Congress today regarding global warming issues, I am not very optimistic about doing much better for Low-Energy Nuclear Reactions technologies either. There are too many conflicts of interest for the short-term at

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the highest levels of Government. By the way, talking of speed, this new technology is our only chance to stop global warming in due time, and actually being able of doing much more just in case the world has already lost too much time studying that problem.

There is another barrier, which is the word "nuclear," for which the general public has developed a strange, unjustified hysteria. It is going to be difficult to convince the public that Low-Energy Nuclear Reactions are actually free of bad radioactive waste, but maybe a little education will do the trick; on that I am very optimistic.

Looking at the future in a positive way, this new industrial revolution can be so powerful that we will rapidly reach a point when the many problems we deal with today in our societies would become trivial, laughable affairs of the past. We will look at what we are doing today and characterize this as the dark ages of technology. Let's imagine a few new possibilities among many:

- There will be no need for gasoline and diesel.
- There will be no need for highly polluting coal-burning power plants nor conventional nuclear power plants that create dangerous nuclear waste.

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- There will be no need for solar panels or windmills that kill birds.
- Cars or trucks will be able to run for tens of thousands miles without worrying about running out of clean energy.
- Every home will be self-sufficient for its clean energy requirements.
- Industry will have all the clean energy it needs and more at a much lower price.
- Clearly, we will have unlimited access to space with absolutely no limitation whatsoever of available energy, opening limitless possibilities.
- The chemical industry will become very different and much cleaner.
- Desalinization of sea water will give unlimited access to water for cities and agriculture in arid, unfriendly areas.
- The atmosphere's excess carbon dioxide will be quickly metabolized by plants, trees and plankton.
- The pollution of the sea will be a bad memory of the past.
- We don't need natural resources, as it may be possible to create stable atoms where we wish and when we wish.

The list can go on and on and make you wonder what we are waiting for; are we that afraid of the unknown? Frankly, when you take a close look at our world

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today, what do we have to lose? I strongly believe LENR is the best ever ambassador of stable world peace.

## PART 4. POSSIBILITIES FOR OUR IDENTITY

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The following chapters have the mission of making the reader's mind think deeply about who we really are. Continuity between chapters is not necessary.

About 100 years ago, a **philosophy originated in the mind of a great scientist.**

Albert Einstein said once with profound seriousness, **“There is something in each of us that no one knows.”**

But, there was something else unique about this remarkable man. The only thing he allowed to invade his mind was the contemplation of *Light*, which was a daily passion that followed him in everything he did and everything he dreamed. He practiced such contemplation with intellect, integrity, and force that has never been equaled by anyone.

No matter how any great mind of our times looked at it, science always makes an attempt to immaterialize matter and, **this is precisely where Albert**

**Einstein excelled** in his awesome search for the ultimate truth we all seek; it is exactly the profound attempt of the Theory of Vacuoles. He further defined the cosmos as “a perfect Universe because of its order and arrangement.”

He was a strong, discrete believer in a supreme being, in a very humble way, and he did not need any human “mortal” to guide him to communicate with the eternal truth. Another quote from him says it all, “There is no way to be a good man by reason alone and there is no way to be honest by logic alone.” No matter how we think, how we analyze and, how we progress in science, **there always will be a certain amount of faith involved in these wonderful processes.**

There is an absolutely unique description of the great man written by an observing friend of his, Dimitri Marianoff, “If you told Albert that his extraordinary intellect and morality, which took him so far in cosmology and in his private life, was the act of God, he would quietly inhale smoke from his pipe, look at you deeply with peace, a faint smile and serenity on his face, and would not answer or make any comment, as for him nothing could improve on total silence on such an occasion.”

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It is critically important for us to explore that silence on which nothing can improve, but this my friends is my private experience as a universal participant and yours as well. Sit down on the top of a mountain, or look at the ocean waves, or at the sunrise or sunset, or at the moon and Venus, or simply at the awesome Milky Way on a clear night, or at a bee walking on a tiny primrose and have that silent exploration; it is worth every second; It is what Carl Sagan did.

It is my deep opinion that there is no possible good science without an act of faith, somewhere, in due time; if done with class, there is nothing wrong with it. For example, it was an act of faith to think in terms of particles as nobody ever saw one; only indirect observations were made which does not qualify to describe what a particle really is. It is an act of faith when we say a large planet revolves around a distant star because of the slight deeming of the light from that star; we indeed never saw the planet; maybe it was a meteor passing nearby in the light path of the star. Sure, if the observation repeats itself over and over, then we know it is indeed something revolving around the star; still we never saw the planet, at least not yet, but as a well-trained statistician I accept the evidence as being very likely.

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Do you really believe in quarks, bosons, gluons or the many particles needed by mathematicians, or strings and sheets? Like it or not, we always act on faith one way or another, and there is nothing wrong with this; this is what models are for; this is what hypotheses are for; if well structured, hypotheses are healthy; this is why the vacuole hypothesis is a valid challenge for our mind because it opens unexplored territories, therefore multitudes of new possibilities, and that is progress. Take a good look at kids today, everywhere around the world; they are thirsty for new possibilities... **and we are getting very late to deliver!**

For such a man, Albert Einstein, to reach heights where no one ever went, to humbly say after receiving the Nobel Prize "for the rest of my life I want to reflect on what *Light* is," was a measure of the formidable force he was. He searched for the real nature of *Light*, and never found the answers. But, the message was important, the will was important, **the direction given to us was important**, as if he was saying to the entire world that we got it all wrong and answers reside somewhere else outside the paradigms in which we are prisoner.

Every statement Einstein ever made ought to be taken very seriously. He was really saying that if the day comes when we can explain what *Light* really is, we will transcend ourselves into totally different beings and we will make a giant

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step in evolution. Well, my friends, *Light* is the only thing that is. Everything is waves in that mysterious medium we may call *Ether*; we are waves and only waves. We are nothing else than a big thought.

## CHAPTER 11

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### IMPLICATIONS FOR OUR VISION OF THE WORLD

#### 11.1 INTRODUCTION

My good friend Oliver Ingamells, reflecting on Louis de Broglie's work<sup>16</sup> introducing the idea of a "subquantum medium" said, "To me, this represents the first recognition of the fact **we should be examining the Universe from inside it and not as though it were on a table outside ourselves!** We are an integral part of our Universe, and it is mandatory to be so during our examination of its, our, properties!" So, my friends, this is exactly what we are going to do. Let's have a vision for a moment, and do not fear hypotheses or paradigm shifts... they are the gates to awesome possibilities.

#### 11.2 FROM VACUOLES TO QUANTUM MECHANICS

With the vacuole hypothesis there is a need to abolish the separation of "me as an observer" and "somebody else as an observed person," or "something else as an observed object." But, for many years in the past, quantum mechanics gradually tried to do just this. If our new way of thinking is right, and I believe it

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is, we need to find ways to abolish the “me and that” and replace it with a fully participatory view, with a compulsory unity with non-material intelligence and where **the notion of time as we know it does not exist**. In a way, the present time may be eternal. The past and the future are the leftover of the paradigm in which we were trapped for more than 6000 years.

I hope the reader realizes by now that as long as he or she looks at the 3-dimensional Universe, the one we are accustomed to, the notion of vacuole does not, cannot make sense. Within our 3-dimensional Universe, we were born once and we will die later on; it is fascinating how this horrible fate affects our ways of thinking in a negative way.

We can be ourselves; we can find ourselves within a 4-dimensional Universe and realize there is no such thing as a newborn or dead body, since you are “**One**” with the 4 or n-dimensional Universe. In a 4-dimensional Universe you cannot be born nor you can die; so religions as we know them today are obsolete, or I should say too naïve. It does not mean we do not need religions, I think we do to reach some kind of social ethic and universal peace, but we must partially reinvent them with the 4-dimensional Universe in mind. I can see millions screaming murder on what I just said. This is precisely the point: they

are indeed incapable of achieving peace, with themselves, with others and with the Universe. Let's be very clear on this issue of paramount importance: for 6000 years we were told what to think. For 6000 years we had a chance to achieve peace and we went nowhere. They had their chance for far too long. Any religion incapable to promote peace with success has nothing to sell: **this is the way it is.**

### 11.3 QUESTION AND CHALLENGE

Photons are presented as if they were entities, like particles with a mass, and like waves with no mass. Can they be both at the same time? That is a big fish to swallow. But, if particles as we know them do not exist, maybe there is no such thing as photons, as we know them. Instead there is *Ether* everywhere, universal, and continuously presented to us under different forms because of vacuoles leading to apparent matter and particles and also presented to us as different wavelengths. *Ether* adjusts its wavelength, contraction, and compaction depending on its "objectives." So the whole "thing," *Ether*, is one continuous entity and fills the entire Universe.

Then, as an example, the supposed collision between an electron and a photon leading to the Compton Effect is only an illusion, or an image of something much subtler. It would be, in fact, an interaction between what looks like particles (i.e.,

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a conglomerate of vacuoles, half the shell of which we can see, and called electron) and a continuous entity, both being the same thing under different physical states, and resulting in a new state of being. So, there are no collisions between particles. Instead there are continuous interactions between different states within the same universal entity and that is exactly why Low-Energy Nuclear Reactions should be taken very seriously. It is very likely there are many ways around the so-called Coulomb barrier.

### **11.4 A SIMPLISTIC ESSAY: THE UNIVERSE IS A BIG THOUGHT.**

To be creative look at two opposite things:

Example #1: Today, when sampling commodities around the world, look at a bad cross-belt sampler and at a good cross-stream sampler, and carefully think about them. Is it possible to create a new idea?

Example #2: Look at the good heart of someone and also at his or her bad temper. Can something new in him or her emerge from such a combination?

Example #3: Look at a spermatozoid and at an ovule. Can something new emerge from them? Yes, birth, as we know it!

Example #4: Look at birth and death. The sketch illustrated in figure 11-1 associates *Ether* and consciousness as being the same universal body. For those who are still reluctant to believe in a Supreme Being, you may replace it

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by the concept of *Universal Entanglement*, which, in itself, requires some kind of awareness anyway: we are just playing with words.

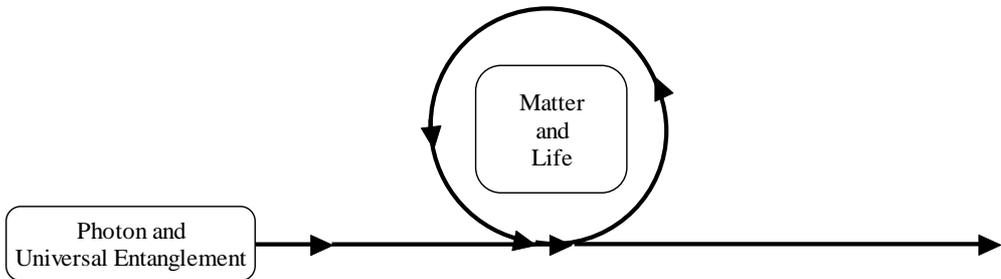


Figure 11-1. There is no discontinuity between what we call “matter” and Universal Entanglement.

Now, the question is: did “consciousness” or “Universal Entanglement” exist before the impact of the sperm and the ovule? We don’t know, but it is very likely. In that case, consciousness must have its source beyond the components of life, beyond the DNA, in the world of particles if such things indeed exist. What if, according to the enclosed Theory of Vacuoles, particles as we see or model them do not exist? Then, consciousness must have its source in the *Ether*, or the so-called photon, to use a pleonasm for clarity, as suggested in figure 11-1. It is the distortion of light leading to vacuoles and matter that

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ultimately leads to life. We could call *Ether* the “Universal Consciousness” (UC) or for scientists, “Universal Entanglement” (UE).

Then, what is life? It is a local creation, for a limited “purpose.” It could be called a Composite Consciousness (CC) or Local Entanglement” (LE).

LE must be focused on one objective only, which is the unknown purpose of our short life-time. To keep life well-focused, it is essential that LE has no knowledge of UE, or so it seems. UE is revealed before and after life, or so it seems. So, what is the barrier between LE and UE? UE is just too much. Life is a composite of trillions and trillions of vacuoles leading to the local, tiny LE.

During our lifetime we receive a huge influx from UE in order to develop LE, do something with it, get creative, take action, and show results. UE comes to us in an infinite number of ways (e.g., what we are born with, food, tools, water, fire, light from the sun and from the stars, love,...). When creativity becomes weak, LE becomes weak, and UE takes the remains to create new, more creative LEs somewhere else, which obviously leads to the intriguing concept of evolution.

God is UE. Allah is UE. Viracocha in ancient civilizations in South America is UE. Make Make in the Rapa Nui civilization is UE. Taaroa in ancient Polynesia

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is UE. All these supreme beings are all one person, under different names depending where you were born and raised among our various civilizations. The “Mana” of Polynesians is an advanced LE and has great powers: it is only a matter of learning how it may help us. So, LE grows and can indeed reach a paroxysm, and then it deflates and dies. But, along the way, something new was created that will help other LEs reach their own paroxysm, and so on. The “new” can be called evolution. What is that “something new” that was created? It can be material, philosophy, religion, mathematics, science, knowledge in general, love, etc, Let’s call it R (i.e., Result), and summarize what we said so far in figure 11-2.

A new question: Can LE tap into UE by its own free will? Why not, for anyone having an open mind? UE constantly flows into LE throughout our life. Think about yourself, meditating, looking at the ocean, or the stars at night, at awesome scenery at the top of a high mountain or at the scientific work of many around you: it is all the same! This is just what we are doing, communicating with something very private, deep, and omnipresent in everything we do; this is what Einstein did all his life. In order to have LE explore UE, the 17<sup>th</sup> century French philosopher René Descartes may help (He was a so-called atheist, which I do not believe at all: when we say such things we are just playing with

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words out of local arrogance.). Just slightly changing his words for the present subject: "Divide a complex LE into smaller LEs. The smaller the LEs the more analytical we are and, therefore, the more discoveries and creativity." So, let's learn how to divide our LE far better, as it is my opinion it is indeed the key to everything. The truth is not out there, beyond galaxies. The truth is in here, at the subquantic level of who we really are, each of us. The ultimate division of LE reveals UE in its splendor, if we can ever reach that limit through deep meditation.

The "Result" R illustrated in figure 11.2 has a strong analogy with the Gamma or X rays emitted from a black hole, as illustrated in figure 11.3, on a very different scale of course. Our creativity is pure energy.

Why is R so necessary? It is energy consuming. R has unpredictable applications and can lead to unpredictable achievements. However, R is not the result of chaos, as UE "does not play with dice," as Albert Einstein would have said. R is simply the key for evolution, to make a local experiment meaningful. UE may truly enjoy a breakthrough! R is a Poisson Process characterized by random breakthroughs for the ordinary statistician. Perhaps, the Poisson Process leading to R is far subtler than a simple random process, which is

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created by our limited imagination in love with mathematical models. It would indeed be naïve to believe, that over the centuries, we reached a level higher than something primitive as far as mathematics are concerned, so let's be humble on this issue. Unless we proceed unconditionally with a paradigm shift and unless we clean up our dimensions and units system there is no need for complex mathematics, or at least not yet.

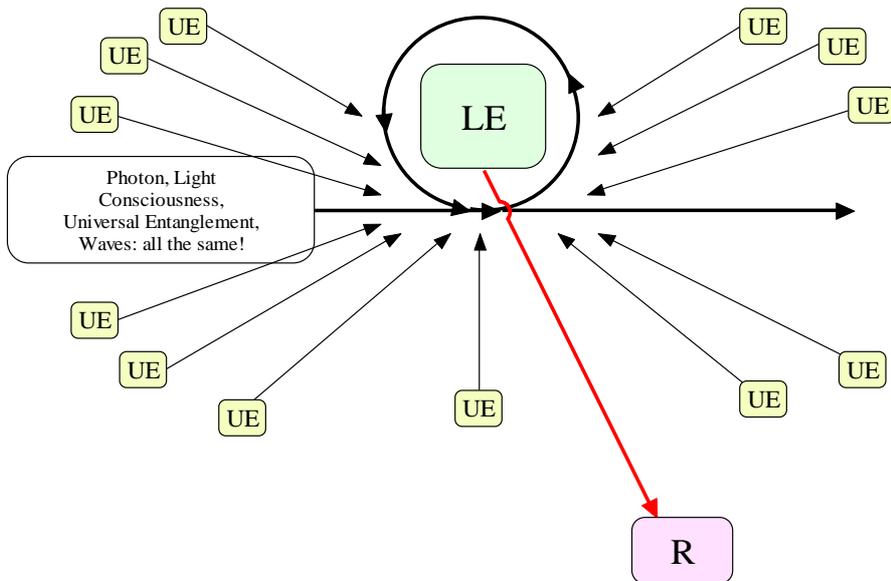


Figure 11-2. Analogy between a black hole and ourselves

R is the product of both chance and necessity. However, there is a distinction to make: chance only reaches well-prepared minds, therefore chance may have to

be redefined as a well-prepared selection process, as a superior, intelligent process. Let's not confuse chance born in a casino and chance leading to well-planned evolution leading to stunning creation.

It would be interesting to speculate on the obvious similarities between R and the massive emission of waves from a black hole, obviously on a totally different scale. The first thing it would suggest is that we have stunning energy stored inside ourselves and, at regular intervals, this source of energy must emit something, always emitting something, better, more complex, just more meaningful.

### **11.5 THE CONCEPT OF AFTERLIFE**

Albert Einstein suggested the concept of quantum or photon entanglement where objects far apart from one another can become linked, say, communicate instantly somehow, regardless of the distance between them. The concept seems very odd at first, if we look at it as an observer. However, as suggested by the vacuole hypothesis, the concept becomes natural and obvious if we accept that matter does not exist, and we or they, alive or dead, are the very same thing that is the universal participant.

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There is no such thing as entangled photons, with one of them necessarily affected by what happens to the other one, regardless of distance. Again, by suggesting the existence of two photons is taking the view of the observer and, as long as we take that view, we will never explain the subtle nature of what we are really made of. By creating the new paradigm where we are "the participant," the only thing there is, with total awareness and consciousness, what happens beyond the grave is a naïve concept we created for ourselves to explain what is beyond the common understanding of Homo Sapiens "vulgaris."

So, the so-called photon entanglement we observe is nothing more than an observer's view of something far deeper and far more universal than what we may think. Let's say "Universal Entanglement" must be the rule rather than the exception. Therefore, I do not believe in the concept of created entanglement or lost entanglement, though it is a concept used in advanced photography, where, once more, we have become the prisoner of the observer's view. Once and for all, take a participant's view then new discoveries will pour like a giant waterfall.

### **11.6 THE CENTER OF A BLACK HOLE**

The perfect vacuum in the core of the vacuole is the true black hole in which absolutely nothing can go, not even electromagnetic waves. The black hole as

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conceived by astronomers is something very different; it is something that is happening beyond what is called an event horizon or beyond a boundary where light or electromagnetic waves cannot return to us. Then, at the center of such black hole there is, possibly, that tiny dot, smaller than the dot at the end of this sentence, into which all the “matter” that previously was in a massive star can collapse. If we look at it with a different eye, using the vacuole hypothesis, all this may be better explained in a far more friendly way.

What happens is that vacuoles making up what we call matter, do indeed collapse or, more exactly, enter into what we see as a black hole. This may happen only under extreme circumstances, such as at the end of a super-star's life that would create the sufficient pressure for vacuoles to collapse or fuse into another entity, such as a worm hole or a string of some kind or a giant vacuole carrying stunning energy on its shell. Our sun, at the end of its life, would not be able to provide such necessary pressure. Electromagnetic waves making up vacuoles may be rearranged so trillions of trillions of vacuoles may become a giant vacuole in which there is no longer anything at all. Then, someone may ask: where did the matter, as we know it, go? Well, there is no matter to begin with, but only electromagnetic waves making the shells of vacuoles, and more and more of them at the singularity center. All those waves may concentrate

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around the giant vacuole, the dot at the end of this sentence, that may now take other forms, such as a wormhole or some kind of tunnel or string at the core of which there is absolutely nothing, however surrounded by stunning energy, and more and more of it. It is the gate for a massive amount of electromagnetic waves to be redistributed throughout the universe to totally unpredictable places; all these possible places are entangled with each other, therefore, they do as they please. All this, of course, is beyond the field of what we can observe as we can only see the ghostly shapes or fields of electromagnetic waves making up vacuoles that, in turn, make up what we can see. In other words, the awesome amount of “matter” present in a massive star can rearrange itself into an elusive wormhole of incredible energy that becomes a life of its own far beyond what we can observe. Then disturbances created by wormholes or strings allow vacuoles to be recreated and transported at any place, any time, as suggested by the famous astronomer Fred Hoyle, perhaps into other distant galaxies, to make up electrons, protons, hydrogen, new stars, etc... The black hole, and the singularity at its center, is the gate to everywhere else; it is the only place where a vacuole can completely vanish and become transformed into something new, something like an electromagnetic wave transportation system to other places where disturbances are needed.

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As tiny vacuoles enter the giant one, electromagnetic waves accumulate at the singularity center, therefore energy accumulates. At some point something has to give up, resulting in a massive gamma ray or X-ray burst. Such burst can repeat itself at regular intervals as new vacuoles pour in. Everything starts to look like a pulsar to us.

The conclusion is clear: a question such as, “what happens to matter that falls into a black hole?” is not a valid question because it is generated by following our old, faulty paradigm about what matter really is, which is absolutely, undeniably false.

In summary, we may say black holes are the key to the creation of hydrogen throughout the entire Universe; all the matter that went into a black hole was consumed in the generation of rays with stunning energy that will create necessary disturbances in the *Ether*, which create electrons and positrons along the way until the waves are exhausted, making such disturbances no longer possible; nevertheless rays continue across the cosmos on other missions.

There is no longer any possible doubt that the famous astronomer Fred Hoyle was completely right; the described cycle of cosmic life makes a lot of sense.

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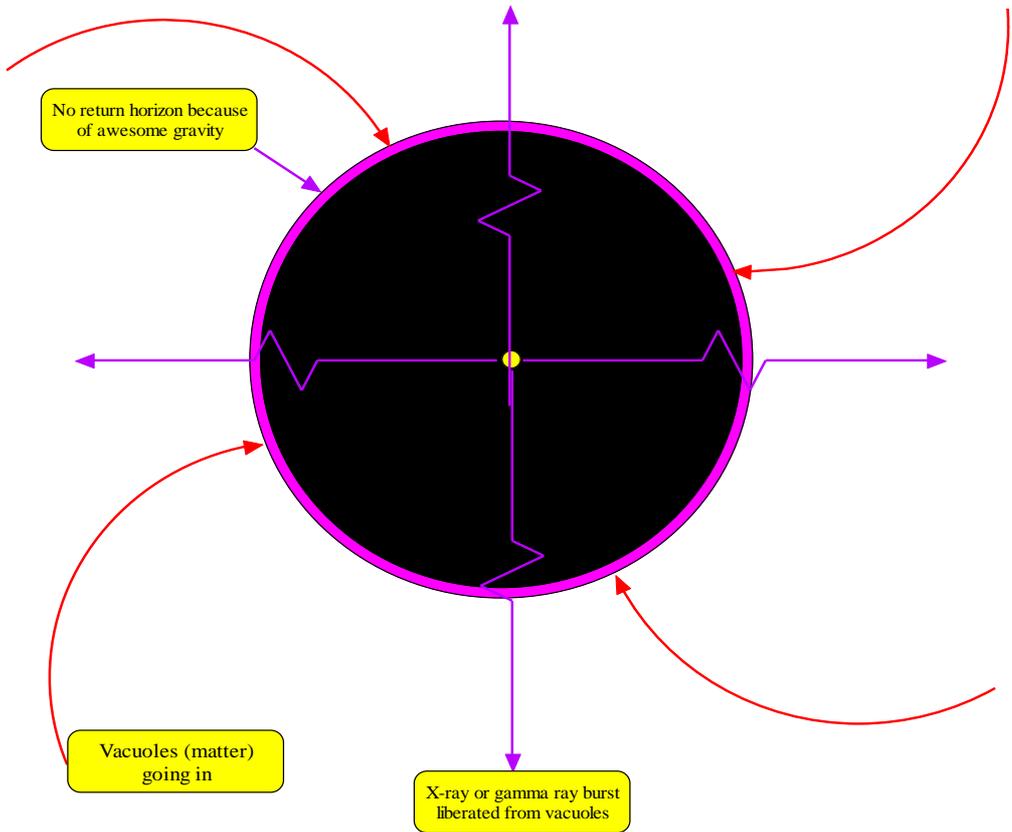


Figure 11-3. Features of a black hole according to the vacuole hypothesis

### 11.7 FROM AN OLD WORLD TO A NEW WORLD

We may ask ourselves: how do we know if we have reached sufficient maturity to explore new worlds? Perhaps, one day we may discover another world that is almost the same as the one we have today. Then, we may be given the second

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chance not to ruin it again the way we have done to this world. In other words, we reach maturity when we are capable of looking carefully at our existing world and carefully fix what is obviously wrong; we don't have to reach other worlds to explore our many forms of energy: they are all there, within us, at all times. It is all waves, and we are the music of the "Gods." Suddenly, you may look at the immensity of the Universe in two different ways: one out there and the other in here, deep inside yourself; either way, the distances are the same!

Basically, we have it all, but we stubbornly insist in living the very same old ways, with the same naivety, the same materialistic needs, the same shortsighted philosophy, and the same old needs to control the lives of others. We act as if the three-dimensional illusion of who we are is indeed something important.

Anyone forcing us to think a certain way is indeed a heretic and dangerous extremist. We should try hard to educate our children on how to think, so they can find the right ways for themselves. By doing so, we would slowly create a much better world and, of course, it may take thousands of years to get there.

## 11.8 ENTROPY

Back from fascinating speculations in Science: thermodynamics says that everything inside any isolated system shall end in a final state, within which all its mass/energy, while quantitatively retained, is entropic and isothermally unavailable, which is, essentially, "dead." Only via input of external energy can an isolated system escape such "death."

Our earth receives a continuous supply of energy from the sun. Some of this energy has been stored in coal, oil and, less obviously, in terrain that permits extraction of energy via hydroelectric and geothermal power plants. Residues of unstable atoms, left by developers, are salvaged and utilized, for good and for bad.

The "standard Model" suggests that all matter/energy originated in a "Big Bang" that created our universe and its corresponding anti-universe. These flew off in opposite directions on a curved path, so that they will meet again someday and annihilate each other in a "Big Rip," then perhaps create another "Big Bang," which will start the whole process over again.

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“New” ideas now seep through the cracks in the “Standard Model”! Perhaps there is a larger “Something” outside our 3-D Universe! A “Something” that includes our Universe, subverts its thermodynamic decay, and feeds it, to keep it alive and viable. These “new” ideas are anathema to the “Standard Model.” Only a few scientists of repute have dared to voice them and, then, only obliquely. Perhaps the best modern example of who dared and got away with it is Roger Penrose: *The Emperor’s New Mind*, Oxford University Press, Oxford, 1989.

### **11.9 LIFE**

“Standard Model” suggests that life on earth began via chance encounters among and between atoms that had organized themselves into molecules. These molecules, by pure chance, organized themselves in such a way that they acquired not only an ability to reproduce, but also an ability to advance themselves into ever more complex forms, each with reproductive capability. Thus, eventually, you and I came to be, to think, to read and write and do arithmetic, to dream, to wonder, to inquire.

If our universe is a closed system, it is surely dying and us with it. If it is not a closed system, it may exist forever, it has existed forever, and it will exist

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forever; for, if it had never existed, it cannot exist! Something must have always been! That we do not understand that “Something” is not good evidence that it does not exist. The Standard Model has proven to itself that a 3-D Universe must eventually die. A few feelers into 4-D adds the possibility that it may periodically be reborn (Big Bang!).

It should be obvious that an n-D Universe cannot be explained in 3-D terms. Attempts to do so are complex and tortuous. Only a few begin to understand them, because they are expressed in 3-D languages such as English, German, Mathematics, French, Russian, etc. The Standard Model is now engaged in papering over its 3-D cracks with green 2-D paper “contributed” by the millions who could care less about the Universe and would rather eat regularly.

Whence their Life!, oh Standard Model? So far your explanation fails! Or, we should say in a nicer language: something of paramount importance is missing, swamped within the trillions of illusions we have created in our minds.

### **11.10 ENTROPY AND INTELLIGENCE**

Consider a closed enthalpic system, such as an active system in the process of “dying” into its, inevitable, entropic condition. The Standard Model suggests the possibility that, what we call “life,” may generate within such a system. Further, this “life” is only initially instinctive and, may in fact, have developed self-determination and auto-intelligence. This happened all via the chance collision of atoms that make molecules, which make living cells, which developed thinking brains that control some fearsomely complex organic machines with personal and special survival instincts. The net effect these creatures have on the closed system we are considering is their application of “intelligence” to meeting their perceived needs, thereby hastening the inevitable decay into an entropic state: slash! burn! pollute! kill! then pray! This is the 3-D Standard Model scenario, nothing to be excited about for sure!

Standard Models have come and gone! The search for Truth may be compared to the search for the headwaters of a river, starting from the limitless ocean into which it pours its endless life. As one proceeds upstream, the river branches; as the only equipment available is a very small canoe, one or the other branch must be chosen. If that one ends in a swamp, go back and explore the other. It too branches, and so on and on.

The final, ultimate, unified Standard Model will contain and explain all things, including all the scraps of Truth that its predecessors have accumulated, and will have cleansed itself from every inherited misconception. No “Model” has yet met this essential! As for the Standard Model, let’s have the courage to go back upstream and find the important tributary we missed.

### **11.11 THE RISE AND FALL OF STANDARD MODELS**

Standard Models, like Empires, rise to a peak of success, then slowly, inevitably, and reluctantly decay. An upstart model rises from the ruin. To achieve ascendancy, it must pick the ruins of the old for everything good therein and fully understand the reasons for the collapse. As the new-born grows, it is challenged by a formidable “Establishment” dedicated to maintaining status quo. Its adherents are ridiculed, ostracized, excommunicated, even put to horrible death; history shows plenty of examples. Wars are fought, won and lost, not just on the battlefield, but intellectual wars between and among competing Standard Models. Only when there is one all-powerful Model, or Empire, is there a semblance of Peace, Law, and Order. Only the innate flaws of the doomed Model betray it.

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Always, it seems, a Prince, a Savior, a Genius, a Hero, a Robin Hood appears, and shoots an arrow accurately into the false heart of the reigning oligarchy. The wars become rekindled.

The current Standard Model is no exception. Its youthful and turbulent beginnings have built upon it to generate an awesome structure. But, in these days, its enormous strength is turned inwards, as its architects and disciples, most of them long gone, direct their energies to proving they were/are right! Their “research” is not directed to the discovery of Truth, but to the proving that their answer was/is the final answer. In our way to discover the Truth, beware the Power of the Standard Model! It can ostracize (Oppenheimer, De Broglie), ridicule (Pasteur), excommunicate (Galileo), crucify (Jesus) and even kill!

### **11.12 GOD**

In these times, there appears and reappears a confrontation between Creationists and Scientists. Since Darwin and the Galapagos, and until very recently, no scientist worth the name espoused the Creationist dogma. The rise of statistics and computer science has led some brave and daring Scientists of renown to publicly declare that the chances of Darwin being totally right are vanishingly small, one in 10100 or so, give or take a few dozen zeros! Of

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course, this suspicion is voiced only very carefully by Scientists with rocklike tenure within the "Establishment." "God does not play dice with the universe!" is the sort of comment that a famous scientist may voice or print only at the risk of ridicule or excommunication!

A primary tenet of the vacuole hypothesis is that the Universe, within which our 3-D Universe exists and, of which it is a part, is a continuous entity that includes everything within itself, including God and any and all Gods that may be. One does not have to look far into the wisdom of the past or the present to discover that this is not a completely new idea!

Schopenhauer's "Die Welt als Wille und Vorstellung" (The World as Will and Representation) and Schroedinger's claim that this "Wille" was the source of his inspiration; the writings of A.A. Milne; John Toland's Pantheism; these, and many other writings, approach the same idea. Lacking, often, is the perception that we, each of us, must be included as participants, not spectators, in the Universe.

A most recent and readable discussion of this subject was written by Paul Davies, *The Cosmic Blueprint* and *The Mind of God*, Simon and Schuster, 1988

and 1991. It seems unnecessary to belabor the subject, except to restate and enlarge upon the first principle of the vacuole hypothesis : **The Universe is a single continuous entity, made of single, continuous stuff and NOTHING ELSE.** We and all living things are made of, physically continuous with, and an integral part of, a three-dimensional slice of the n-dimensional Universe. God either is or is not and it is not the objective of this essay to debate this, however, the subject is with us, scientists or not, every day of our lives. If He/She/It is, He/She/It is also a continuous part of the whole, most probably extending outside our 3-D slice, and who provides the laws and the order and the life of which we are aware, and, of which we feel obliged to try to understand.

It is this perception that necessitates the vacuoles; for “particles” cannot otherwise exist as separate entities in space. The correspondence of vacuoles, which are integral multiples of a unit vacuole, has been demonstrated. The first try at developing the idea, through examination of the periodic table of the elements, was encouraging. Further development led to a new unitary system and the possibility of reducing the number of physical constants, a possibility first suggested by Eddington. But! Vacuoles must exist in a medium! Hence, my resurrection of the forbidden word *Ether*. True space, true vacuum, exists only

within the vacuoles! They are the edge and the only edge of our curved Universe.

### 11.13 ETHER

In this essay we use the forbidden word -- *Ether*! The *Ether* is the Universe. Motion is of two kinds. Vacuoles are carried along by the motion of the fluid *Ether* or moves as waves, or other disturbances, or moving concentrations of the *Ether*. Each observer, flowing with the *Ether*, of which he is a part, sees, feels, and knows this from his unique point of reference: himself.

The velocity of pure radiation, which is the speed of light, is a property of the *Ether*, and will pass each observer at the same speed. The planets do not move through the *Ether*, they flow with it. Of course, we cannot measure an *Ether* drift! Of course, light is slowed as it passes.

## CHAPTER 12

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### A VIEW OF OUR DESTINY

Now the question is: “what could our destiny in this eternal 3-D present (i.e., the time-thickness  $2 \cdot t \cdot r$ ) be?” You may have noticed that in our new *LP $\rho$ CN* system of dimensions and units, time units are never a factor; there must be a subtle reason behind this. So, the new paradigm is a Universe where time, as we know it, is no longer a factor of its own. It is, instead, a factor relative to surface, density, and pressure; or, which are equivalent, a factor relative to length and magnetic field strength. Therefore time, as we know it, is like an effect, rather than a cause; it is a **circumstantial**, secondary property instead of a **structural**, primary property. It is of the utmost importance to make this distinction, because we have absolutely no control over a circumstantial property and we know too well, within our present paradigm, we can neither stop time nor go back in time.

However, when we know the structural causes of time, it may become much easier to predict how a length, a surface, a pressure or a magnetic field strength may change, or may be altered,... **as we wish**.

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This may open new possibilities... food for thought!

## CONCLUSIONS

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We reached the end of our humble journey within this preliminary essay. There are a certain number of conclusions that should allow us to make a long overdue change to an obsolete paradigm. It is now up to physicists, all around the world, to take a deep breath and continue the journey beyond the door we just opened... with huge new possibilities.

- The International System or any older system of dimensions and units is appropriate for building cars, houses, and airplanes. It is cumbersome and unnecessarily complicated for advanced nuclear physics and astronomy. Indeed, we have clearly demonstrated that time, mass, permeability, and permittivity don't need dimensions of their own. In the new system  $NU$  we suggested, **all values for the fundamental physical constants are absolute, with the exception of the time-thickness constant.**

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- A fascinating proposition from the Theory of Vacuoles is that the dimensions of electric permittivity are a ratio  $\frac{1}{\text{pressure}}$ , with a numerical value of 1 in all systems, and those of permeability are those of density.
- Time and mass are relative concepts created by our vision of the 3-dimensional Universe in which we live every day. As defined by our senses, time and mass do not exist in the ways we think in the n-dimensional Universe.
- In our suggested system, all the physical constants can be expressed in terms of 1, 2, 3,  $\pi$  and  $t$ , which is hardly a coincidence and, therefore, we did something right.
- The only stuff in the n-dimensional Universe is *Ether*, however, it is not defined in the old naïve ways.
- Particles making up matter are only disturbances within *Ether*, or arrangements of waves.
- Particles, as we know them, do not exist. They are holes (i.e., vacuoles) in the universal medium and these holes are surrounded by shells made of highly energetic waves.
- We are waves and waves only, which perhaps explain our fascination for light waves, sound waves, sea waves, etc...

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- Protons are vacuoles or assemblages of vacuoles that we observe within our 3-dimensional Universe.
- Positrons are protons travelling in a 4-dimensional or n-dimensional Universe; they cross our 3-dimensional Universe  $1/1836^{\text{th}}$  of our time, which explains the apparent difference in the mass of the proton and the mass of the positron as a dramatic coincidence trying hard to point to something of paramount importance.
- If protons and positrons are the same thing, then antimatter can coexist with matter under specific conditions. We don't have to explore the Universe to find out where antimatter is and, none the less, the concept of antimatter should be redefined as it is not at all what we think it is and the name is highly misleading.
- Black holes emit gamma rays carrying stunning energy that constantly create new matter or pairs of what we call electrons and positrons. Therefore, the famous astronomer, Sir Fred Hoyle was right all along with the "Steady State" theory. Indeed, the Theory of Vacuoles is telling us that whatever the *Ether* is, is what it is and it does not change. It is the part of *Ether* that has been disturbed that may change. In other words, it is the part of the Universe we can detect with our instruments,

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which are themselves made of disturbances that may change. Matter vanishes in black holes, but is recreated following the powerful emission of X-ray and gamma ray bursts.

- Between the scale at which vacuoles are born and our observations at the scale of Fred Hoyle's Steady Universe, there are roughly 40 orders of magnitude, or more. Yet, explanations given in this essay seem to fit well, regardless of the scale. Our suggestion is that universal entanglement is a supreme rule: everything in the Universe is intimately connected. There is no such thing as any of us there, where we now stand, and then, farther away the Universe we observe. Each of us is **"One"** with the Universe and connected to everything we may observe or even imagine... so long for the local concept of birth and death! Food for thought: we don't know how to take advantage of this universal connection, yet; but, the time may come!
- At the so-called Big Bang time, likely to be a minor event, some of the matter we observe was created. However, every second since that time, and even now, matter is constantly being created by X-rays and gamma rays loaded with extremely high energy; they are the cause of disturbances in the universal medium. As we speak, new matter is

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created everywhere... as a result, there is no way to figure out how much matter there is in the Universe; it is an exercise in futility because it is a little pulsing fraction of what is... Let's explain more.

- Obviously, matter, as we know it, disappears within black holes into a big rip, just to generate X-rays and gamma rays with phenomenal energy that will recreate somewhere new matter and new worlds... and a lot of them. And so the cycle goes.
- Black holes, super-novas, pulsars, and even lightning on earth and other planets are all creators of new matter in an eternally pulsing Universe.
- Now, we most certainly can better understand where we are coming from... and perhaps where we are going to and how.
- Above all, our mind is not separate from matter. Everyone and our respective minds are not separated from everything we observe in a 3-dimensional Universe. When we talk about the Universe, in which we live, we mostly refer to a "visible" world that can somehow respond to the observing machines that we have created, and we don't realize that we are looking at only a small part of what the real Universe is; this is the subtle proposition of the Theory of Vacuoles.

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- Finally, the Theory of Vacuoles strongly suggests that we redefine what the Coulomb barrier is and, especially search for new ways to bypass its formidable challenge.
- To help us in this important endeavor, with our new suggested system of dimensions and unit we demonstrated beyond any possible doubt that the electric charge is a surface area. Then, as perhaps the most dramatic conclusion of all, protons and positrons which have exactly the same electric charge, therefore have exactly the same surface area. This alone is a fascinating coincidence that should make nuclear physicists carefully think about the consequences and especially the possibilities.
- All these conclusions combined should give us the necessary tools to completely rethink the fascinating subject of Low-Energy Nuclear Reactions. It is our opinion we provided a good tool with the information displayed in table 10-1.
- A careful study of table 10-1 with displayed  $\frac{x^{\frac{3}{2}}}{y}$  ratios may help us to add one too many neutron into some nuclei. That unwelcome neutron, under gentle conditions, may be forced to decay into a proton and an electron. One proton is born in-situ leading to a neighboring, superior atomic number.

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follows: "I have often been impressed by the scanty attention paid even by original workers in physics to the great principle of similitude. It happens not infrequently that results in the form of *laws* are put forward as novelties on the basis of elaborate experiments which might have been predicted a priori after a few minutes consideration." (Nature, 95, 66).

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