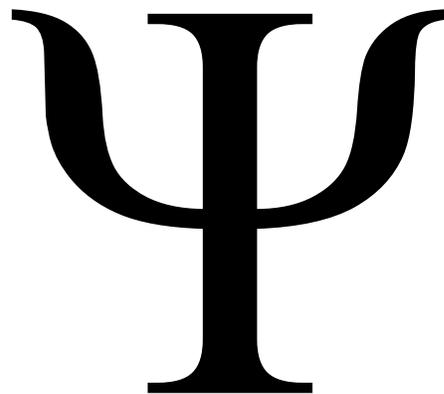


NO ACCIDENT

UNABRIDGED DELUXE SPECIAL EDITION



**HOW QUANTUM THEORY
DISPROVES RANDOMNESS**

**The pursuit of truth requires courage,
or it is the pursuit of something else.**

PLEASE, STOP AND READ FIRST!

Please note that if the reader embraces mysteries* or beliefs that he or she is convinced that they genuinely love, and he or she wishes to continue loving them, on, into the future, especially if they depend upon these ideas as a source of excitement, essential to their happiness, then the reader should not turn another page of this book. Mystery and belief CAN be exciting, especially when we are children (and as long as they are ultimately not mistakenly confused with real, physical truth, or, in particular, here in this text, confused with genuine scientific fact). Learning science, by virtue of science being the very pursuit of the discovery of physical truth, cannot avoid dispelling mystery and belief in the course of replacing them with explanation and understanding, because that is exactly what science does. In the process, the mysteries and beliefs that we may be convinced add so much to our lives, lose their capacity for doing so with the acquisition of accurate scientific knowledge. Thereafter, they may come to entertain and excite us little more, and in this way be 'gone' from our lives irrecoverably, forever, because explanation and understanding, once acquired, are never easily, if at all, really ever wholly forgotten. So if, for whatever reason, you wish to continue retaining your mysteries and beliefs, then close the book immediately after finishing reading this page, and do not open it ever again, until these ideas that might mean so much to you now, someday begin to falter in their power to bring joy, upon being faced with the certainty of the rigors that the immediate and unassailable realities of the actual, physical facts of life, as you age, are sure to eventually present in progressively greater and greater, abundance and frequency, with the continued passage of time. Should this moment arrive, the reader may then wish to revisit this page and choose to finally turn it, in order to begin discovering that the *true* story of how nature really works is *magnitudes and magnitudes* richer, deeper, grander, and far, far more beautiful, than any conjured mystery or mere belief *could ever hope to even begin to approach* (which again, to be perfectly clear, is an absolutely irrefutably true, physical fact, that turning this page and all those that follow, can begin to reveal, *to absolutely anyone, who is willing to think*).

* - Scientific mystery excluded.

**Mystery* and belief
are synonyms for
ignorance* and fear.**

* - Scientific mystery **included**. In science, besides being a synonym for ignorance, mystery is a synonym for opportunity (to discover).

NO ACCIDENT

by Chongo in collaboration with José
Unabridged Deluxe Special Edition

**HOW
QUANTUM
THEORY
DISPROVES
RANDOMNESS**

“In the life of a man, his time is but a moment, his bearing an incessant flux, his senses a dim flash of light, his body a prey for worms, his soul an unquiet eddy, his fortune dark, and his fame doubtful. In short, all that is of the body is like flowing water, all that is of the soul as dreams and vapors; life a warfare, a brief sojourning in an alien land, and after[ward] ... oblivion.

Where then can man find the power to guide and guard his steps?

In one thing and one alone: the love of knowledge.”

–Marcus Aurelius, Emperor of Rome, *Meditations*

Ψ

IN THE TWENTY FIRST CENTURY EVERYONE NEEDS

TO KNOW ABOUT THE FOUNDATIONS OF SCIENCE

This book is designed to educate. That is, to educate anyone in the foundations of what is commonly perceived as an extremely difficult subject, namely, theoretical physics. This is done by excluding all math. Picture illustrations and words are used instead. Pictures and words are all that are needed for explaining the concepts of theoretical physics, like quantum theory, for example.

Contrary to popular belief, the foundations of theoretical physics are not complex but simple, which is why everyone who can should learn them. At its heart, theoretical physics is easy to understand and can be grasped within a few months, leaving the individual who chooses to learn it intellectually far, far stronger than they would have been without it. Surely it is mistakenly perceived otherwise because such understanding has not yet become commonly widespread. Once, neither was reading skill; the world was mostly illiterate, and ignorance ruled. Today, nearly everyone reads, and a far better world than one without widespread literacy is the result. Now, just as life is enriched by so many being literate, so can it be even more by everyone understanding accurately how nature really works, starting with the *foundations* that describe it best, starting with energy's most fundamental, namely, the Theory of Quantum Mechanics, the most accurate description of nature's energy ever conceived.

An accurate understanding of nature changes forever one's view of the world, and provides hope for its future. For most, life itself is now better than it has ever been in human history, thanks in enormous part to science, genuine science, providing the marvels that so enrich our lives, like long life spans, travel, communication, and health, just to mention a few. Life would be much, much less, in the absence of modern scientific understanding, no less than it would, again, most certainly be, in the absence of simple literacy being commonplace. On the whole, people benefit from our more modern world filled with more and greater opportunities for humankind than a less modern world, one lacking genuine scientific understanding (one lacking its foundations, one lacking quantum theory) could ever offer instead. The more, overall who learn science, the richer the world becomes.

You can help yourself individually and help everyone else collectively in the process, by learning about the simple idea that the Theory of Quantum Mechanics is. Learning is far, far easier than one might have ever imagined. And, because quantum theory is easily grasped, once learned, this understanding lasts for the duration of one's entire lifetime, again, very, very easily. It is our nature, as thinking beings.



DEDICATION

This book is dedicated to the memory of a committed thinker, physicist, mathematician, a very conscientious human being, a scientist, a world-class rock climber, a skilled outdoorsman, as well as my tutor, collaborator, and best friend, José. His understanding of nature led to my ultimate understanding of it, which will hopefully, eventually lead to many other people's ultimate understanding of it too, as José would have wished.

“The real voyage of discovery is not in seeing new landscapes but in having new eyes.”

–Marcel Proust

FOREWORD

By Victor Pereyra, Professor of Mathematics, Stanford University

In the few years that began the twentieth century, Albert Einstein's Theory of Relativity revolutionized the world of physics by showing that Newton's account of natural laws did not model nature's motions accurately. At about this same time, a new model, named the Theory of Quantum Mechanics, expressed the individual wave character of all energy. Like no others before, these two descriptions of the world changed our understanding of the smallest to the largest, and everything in between, forever, enduring now over a century of repeated testing, with exquisite and unparalleled accuracy and precision, having never failed even once. Together, these two descriptions of the world encompass everything existent in nature, including our very awareness of life. No other body of ideas ever imagined even comes close in performance and revelation.

The consequences of these two giant leaps in science have had immense repercussions in everyday life. From atomic bombs to nuclear energy, from computers to cell phones, lasers and microwave ovens, the Theory of Relativity and the Theory of Quantum Mechanics have changed the world in which we live, in every way. Now,

after more than a century of unprecedented success, common and widespread understanding of these brilliant intellectual tools is still limited to the very few, even though the fundamentals can be understood by anyone capable of reading and of grasping the most simple of abstract ideas.

This work attempts to expose people to the simple ideas underlying these two magnificent accomplishments, and in so doing, advance overall human understanding of nature, by explaining these ideas in great conceptual depth, but without resorting to any mathematics whatsoever. Nature's founding principles are explained, using only words, a few illustrations, and a simplification of our own reality, by means of an imaginary world inhabited by much less complex, two-dimensional versions of us. Though far simpler than ourselves, just like us, these two-dimensional creatures discover the relativity of space and time measures with respect to the motion and gravity characterizing their much simpler world.

Next, these creatures discover their own version of the Theory of Quantum Mechanics, identical to ours. In doing so, their story shows us how we, much more complex three-dimensional creatures, in our much more complex three-dimensional world, can do the very same. And, we can do so far more easily, given our additional dimension of depth and its matching insight, by following their rich story of scientific discovery, which parallels our own even richer story. Together, the Theory of Relativity and the Theory of Quantum Mechanics comprise the most fundamental and accurate working description of space, time, and everything in them that has ever been conceived. They ultimately even lead to explaining life itself, and moreover, can flatly demonstrate life's distinction in actual physical experiments.

The foggy veil of mystery that seems to surround physics is a mere illusion. It exists only in a lack of a comprehensible exposure to the subject matter. This veil serves, no less than it has throughout human history, only as barrier to beholding what can be the richest, most interesting, and most lasting aspects of nature. Seeing through the illusion that that mystery is reveals a stunning beauty that lies hidden beneath this veil.

No mysteries need stand between us, and our understanding anything. If we simply choose to learn for ourselves the truths that science has worked so tenaciously, often at the price of enormous living sacrifice, to identify, we will discover that anyone can comprehend anything they wish to comprehend about natural phenomena, utilizing the sound conclusions of science as a foundation. No formal education is needed for this text. Simply choosing to learn is the only real step that one must take. All subsequent steps are far, far easier.

Understanding science begins with understanding its most fundamental description of the world, the Theory of Relativity and the Theory of Quantum Mechanics, which are, unquestionably, among the most outstanding of all human achievements, short of humankind's refinement of courage, insight, compassion, and liberty. Science gives these refinements, and many others like them that are their outcome, wings, so that humanity can soar, by each individual one of us being able to do so, if nowhere else, then in our minds.

The foremost purpose of this book is
to make available to those having the least access
to the most advanced achievements and discoveries in science,
an open window
into its most fundamental foundations
so that they too can have that access.
This is my opus.



PUBLISHING DETAILS

Publication Date: September 2017

Edition: Final (Deluxe Version)

Editors: Cybelle Blood, and many, many, others too numerous to name.

Illustrations: Lee Parks

Critical Technical Support: Werner Braun and Lee Parks

Science: D-Wave Systems (the most powerful quantum computers in the world), and In particular,

Chief Scientist, Founder and winner of the 2015 John Bell Award, physicist Eric Ladizinsky

Development: Ms. Dragon Print & Copy, Altadena, California

Inquiries: **www.chongonation.org**

The term "infinity" replaces the term "effective infinitude" throughout. This was done first, to accommodate the understanding of the lay reader, who may be unfamiliar with the latter term, but also, for fitting the text within the original number of pages allowed, while maintaining an adequately large font for easy unaided reading. (And if the number of possible histories for reality is finite, then this term may refer to what is actually a finite number, but nonetheless, one that is so staggeringly big that it is effectively infinite. Application of the term outside of this context makes reference to a genuine infinitude, which may be either countable or uncountable infinitudes, whichever applies.)

NO ACCIDENT HOW QUANTUM THEORY DISPROVES RANDOMNESS

by Chongo in collaboration with José

(Formerly, *The Infinite Pattern, Explaining Nature*)

Deluxe Unabridged Special Edition

September 2017

www.chongonation.org

© Copyright 2017, Charles Victor Tucker III (Chongo), All rights reserved.

No text whatsoever, in whole or in part, may be copied or in any way reproduced.

TABLE OF CONTENTS

| | |
|----------------|----|
| Preface | i |
| Prologue | ii |

EXPLAINING NATURE...

| | |
|------------------------|----|
| Warning Advisory | xi |
| I. Foundations | 1 |

SPACE AND TIME (RELATIVITY)...

| | |
|--|----|
| II. The Inseparability of Space and Time Means the Relativity of Space and Time Measures | 7 |
| III. The Simple Complexity of Classical Reality | 34 |

ENERGY (QUANTUM THEORY, THE CONVENTIONAL EXPLANATION)...

| | |
|--|----|
| IV. Real Reality and the Rhythm of Quantum Mechanics | 46 |
| V. A Hidden Universe Beneath | 68 |

A SINGLE WORLD, ALONE, JUST ONCE, AND NEVER AGAIN...

| | |
|---------------------------------|-----|
| VI. Touch of the Observer | 92 |
| VII. Decisions of Nature | 106 |

ONE WORLD, AMONG MANY, AND MANY, AMONG EVEN MORE,

ALL BOUND TO EACH OTHER, IN UNENDING REPETITION...

| | |
|-----------------------------------|-----|
| VIII. The Infinite Pattern* | 122 |
| Epilogue | 138 |

APPENDIX, GLOSSARY, AND INDEX...

| | |
|--|-----|
| Appendix A, Riding a Beam of Light | 142 |
| Appendix B, The Universe is Round | 145 |
| Appendix C, The Axioms of Quantum Theory | 152 |
| Glossary and Index | 153 |

| | |
|------------------------|-----|
| Acknowledgements | 156 |
|------------------------|-----|

POSTSCRIPT: INTERPRETATION AND MEANING...

| | |
|--------------------------------|-----|
| A Humanist's Perspective | 158 |
|--------------------------------|-----|

* -The term "pattern" used in the title could easily be replaced by the term "formulation" or "computation," either of which are perfect synonyms for what the content explains.

The term "infinity" replaces the term "effective infinitude" throughout. This was done first, to accommodate the understanding of the lay reader, who may be unfamiliar with the latter term, but also, for fitting the text within the original number of pages allowed, while maintaining an adequately large font for easy unaided reading. (And if the number of possible histories for reality is finite, then this term may refer to what is actually a finite number, but nonetheless, one that is so staggeringly big that it is effectively infinite. Application of the term outside of this context makes reference to a genuine infinitude, which may be either countable or uncountable infinities, whichever applies.)

"The most incomprehensible thing about the universe is that it *is* comprehensible."

—Albert Einstein

PREFACE

We live in a quantum universe, and there is a reason why we do: we must. Were our universe any other kind of universe besides a quantum one, then 'we' would not exist in it, nor would anything. Fortunately for us, our universe *is* a quantum universe, and because it is, 'something', each one of us, is here in it, very *alive*, along with everything else required that allows us to be. This book is a description of the principles upon which our quantum universe operates and an explanation of why these principles are what they are. Perhaps most of all, it is an exploration into the reasons why these principles *must* be what they are, and why they can be no others, in this universe.

In understanding this description, we can uncover the stunning beauty that lies beneath everything we observe, removing the myths and misunderstandings that have, now even up into these modern times, always

stood between us and what is really true about anything. Understanding the principles upon which a quantum reality is based can introduce anyone who simply wishes to know what is truest in nature, to a completely new way to see the universe, and possibly even a new way to consider physical existence.

Understanding the founding principles upon which our world is based can reveal why the smallest and most fundamental particles of nature (which includes *every last* bigger thing that is made of these particles) are actually finite partial ‘representations’ (projections) of something that is not finite at all, but infinite. In this way, we can see that a particle and a wave are two aspects of the very same thing, and thereby discover why physical existence is simply a shape and how all motion is just the shape of the universe changing, as we and everything living roll down a one-way road called time, observing the contours of this shape with each moment of our journey, in a connected series of moments that we call being alive.

By describing physical existence in this new way, we can ultimately discover the very nature of our awareness, and thus discover the true nature of all awareness anywhere; as well as its enormous significance in very real, very physical, and indeed very tangible and understandable terms. Using the conclusions made by physical science, namely, the Theory of Relativity and then the Theory of Quantum Mechanics, the book you are holding in your hand will explain exactly ‘what’ life is, precisely ‘why’ life is, and most importantly, **why life absolutely must be**, for there to be anything existent or purposeful at all!

This is the story of the Theory of Quantum Mechanics, described in a very simple manner, without any mathematical notation. Quantum theory can lead us to see why the universe is the way it is, by the necessity which is ‘implied’ by the other working physical theory, the Theory of Relativity, but which is **absolutely REQUIRED** by quantum theory. That necessity is the necessity for an observer in a universe, an observer who is ‘alive’ and who is ‘aware’ of something, *anything*. The presence of an observer and the fact that no observer is preferred (by the laws of nature) over any other lead not only to the inevitability of relativity for describing space and time, but to the inevitability of quantum mechanics too, for describing those things which lie within relativity’s space and time.

Quantum mechanics is an outcome of a universe characterized by constant and ongoing observation. The chapters that follow will explain how observation and the life that observation implies are a most natural and inescapable consequence of any physically ‘real’ universe. Most amazingly, living observers emerge because they absolutely *must* emerge, for the sake of a very naturally occurring and absolutely unavoidable ‘inevitability’, the all-encompassing one that we call “existence.” This, in a nutshell, is the substance of this book’s content and what it attempts to explain.

"The first step toward imagining something new is often to cease the imagining of something old – thus making room for the new."

PROLOGUE

IMPORTANT: If the reader already accepts the validity of the theoretical model and need no explanation of the basis for this validity, especially if he or she has read and understood the companion volume, *The Infinite Ocean*, then he or she may wish to proceed directly to the actual subject matter of the content, starting with the first actual chapter, which begins on page 1, ten pages ahead.

By addressing the subject of theoretical physics, one is compelled to ask, how in the world can an understanding of nature's deepest truths enrich one's life experience? What exactly are the benefits that a conceptual grasp of quantum theory, based upon first understanding relativity, yields, that can be applied in everyday practice? How can the contemplation of the motion of subatomic particles, particles that are far too small to ever be seen and whose existence can only be inferred, improve our participation in the big motions occurring around us and in us always? Why learn such a seemingly abstract subject?

First, to explain why, it is appropriate to state that, from the point of view of those individuals who have acquired such an understanding (not the least of which are the collaborator and the author), gaining it is as worthwhile an endeavor as one could ever pursue. According to this view, achieving an understanding of the founding principles, upon which nature – indeed, upon which existence – is based, matches the thrill of living the most exciting adventure, the satisfaction that comes from solving the most elusive puzzle, or the fulfillment of gratifying the deepest passion (all of which the collaborator and author have both genuinely known first hand). Indeed, such an understanding of the physical world can be bliss itself. Nonetheless, the realization of these esoteric rewards is always subject to the preferences of the individual, not to mention the faith that an individual might have in realizing them. So, one need not, necessarily, seek only these apparently intangible benefits, anticipating no others; there are others also.

The most practical and tangible reward that an accurate conceptual understanding of theoretical physics renders is that it makes understanding everything that 'is' reality much easier too, than does a lack of such an understanding. Having it, we can consider nature's phenomena using altogether new ways of thinking and using ideas that we probably (unless we already possess them) never imagined before. Remarkably, by having this new understanding, we can even shape our very wants, by understanding 'why' we even 'want' at all. That is to say, an understanding of quantum mechanics provides genuinely new ways of dealing with the world, ways that can provide the mind with completely new concepts and wholly new insights upon which to base its (i.e. our) decisions, concepts and insights that would simply never exist in our old ways of thinking (unless these old ways incorporated a valid theoretical model). In understanding genuine science as the pursuit of natural truth, we gain

intellectual tools that we may have imagined only others ever being capable of possessing, not us. But 'we', meaning anyone, can possess these very same tools, too!

Armed with these tools, we (as stated, anyone) can begin to see nature's founding design. Nature's ways need not be mysteries if we choose that they not be. Beyond mystery's illusion lies an elegant, abstract beauty that nature's apparent design encompasses. In recognizing the depth and extent of this beauty, one cannot help but come to appreciate the rigors utilized, that provided the means for arriving at these new ways of thinking, rigors that we (again, anyone) can apply in understanding anything. Science demonstrates that nature does not use mysterious powers for performing its apparent 'miracles'. It does not 'use' such things because it flatly never needs to do so.

Most wonderfully, and perhaps more so than all the other benefits, an understanding of physical theory (but in particular, an understanding, be it only in the most simplified, general, and conceptual terms only, of quantum theory) can identify those conventional notions that fail in the face of accurate understanding, exposing them for what they really are (and always were anyway): simply untrue. This, in turn, provides the opportunity for embracing those notions that demonstrate themselves to be consistent with nature and hence to be true in it, which are the very notions revealed by the theoretical model. Ignoring false notions and replacing them with true ones reveals the elusive yet magnificent beauty that quietly hides in nature's seeming mysteries, introducing reason as an alternative to patterned (reflexive) reaction. This hidden beauty waits, patiently indifferent, to be revealed by our understanding of it; starting with the simple idea of natural truth. Real science is the pursuit of natural truth, objective truth, truth that may be much, much different from what one might imagine truth being according to 'conventional', nonscientific views. Ideally, truth is not subjective for science, despite it so often commonly seeming to serve nothing else.

Most of us might be convinced that our thoughts dwell in a world of facts, fantasies, and beliefs, while our feelings dwell in a world of observation and sensation. Without giving it any deeper consideration, we might believe that thoughts and feelings sum up the extent of human reality, since, from the point of view of most humans, both together adequately describe any human experience, with human action being the outcome of this experience. Furthermore, we might distinguish this human reality, qualifying some of it as being 'true', with the rest being something else, like 'falsehood', for example, differentiating one from the other by designating some of it true and the rest of it not. We might be certain that facts are true, that fantasies are not, and that the truth of opinions and beliefs varies, from one opinion or belief, or one individual, to another. What some might say is fantasy, others might believe true, or at least so claim. Considered in this way, the concept of 'true' hence becomes indistinguishable from opinion or belief of what is, unlimited in its scope, its definition now made indefinite, as a consequence, clouded by subjectivity and vagueness. Truth can thus take on an altogether new and distinct meaning, one having nothing whatsoever to do with factual demonstrability.

Thus, by demeaning truth, by reducing it to a synonym for opinion or belief, we also broaden its meaning, since, by being opinion or belief, truth's meaning then becomes easily malleable. Accordingly, truth can then become anything and everything that one ever wants truth to be, again, even fantasy, because that is exactly what opinion or belief is: whatever we want to be true (by virtue of what our preferences might even convince us must be true and therefore is). Considering truth as being nothing more than opinion or belief, and considering its pursuit as being nothing more than the pursuit of justification for a particular opinion or belief is a very 'easy'

thing to do, because it requires only that truth mean something – anything at all – according to what we need it to mean – conveniently - at the time that we happen to use the term.

The common attitude that truth is nothing more than opinion or belief is embodied in the statement: "what's true today can change tomorrow." This meaning of truth is often extended to include 'all' truth, making any truth no more permanent than opinion and belief are convenient, thus allowing opinion or belief to have equal validity as truth. Defining truth in this way allows our opinions and beliefs to remain as true as we wish them to, because there exists nothing capable of demonstrating otherwise within the context of what might be our most rigorous test of truth, namely our personal preferences, upon which our opinions and beliefs, and hence upon which our subjective truths must then be based. But, this kind of common idea about truth is not the same idea about truth that science, at least physical science, embraces, legitimately. For physical science, opinion or belief has no place at all in determining what is true. For physical science, truth is something 'much more substantial' than opinion or belief. For it, opinion and belief are what truth is not. For physical science, truth is determined by 'accuracy', thus introducing an extremely important idea for specifying truth, namely that of a "theory." 'Theory', specifically, a scientific theory, is the term that science uses to identify nature's truths. This may be very different from what most imagine a theory being.

Just as it is for the word 'true', the common understanding of the term 'theory' is quite often and quite erroneously considered to be synonymous with the word opinion, or with the word belief. Incorrectly, many people consider a theory as being the conjecture of an opinion or the sentimental assertion of faith in a belief that is, at best, a hypothesis about the nature of reality, no less valid than any other hypothesis. However, for physical science, the hypothesis of opinion and belief has no place at all in determining what is true about nature (which is what a scientific theory does: specify what is true about nature). For physical science, there is no more room for opinion or belief in the specification of what is true and what is not, in nature (again, a theory), any more than there is room for exaggeration and misrepresentation in the accuracy of scientific measurement and description. For physical science, truth is determined by accuracy (and by nothing else), thus revealing what is the fundamental idea underlying physical science's very pursuit of truth, and the means it uses for specifying what 'truth' is in nature, namely, a scientific 'theory'. Again, like truth, theory is a term that is very commonly misunderstood by those unfamiliar with science, and indeed even often by a great number who are familiar with science (even by many presumably familiar with physical science).

According to physical science's definition, a theory is neither the conjecture of opinion nor the belief in assertion. 'Theory' is the word that physical science, and in particular, the most physical science there is, physics, uses for specifying truth – a most precise truth, far more precise than any opinion or belief could ever be; which makes a scientific 'theory' the truest description that there can ever be for explaining nature, short of an individual's genuine understanding of (as opposed to opinion about or belief in) the same. This is for the simple reason that for a theory, to truly (again, according to physical science's definition) be a genuine, scientific theory, it **MUST ALWAYS** strictly agree with what is observed and **NEVER** disagree, ever. In short, for a theory to be a scientific theory, that theory **MUST** be testable. That is, it must be possible to make observations that are consistent with what the theory predicts will be observed, or that are not, should the theory be incorrect. According to this definition, should a "theory" ever, under any set of

circumstances whatsoever, clearly disagree in any way at all with what is observed, then physical science's definition no longer applies. It is this rigorous scrutiny that makes a scientific theory absolutely the greatest expression of what is true in nature (as well as what is not) that there can ever be, unquestionably.

For a theory to be a scientific theory, it must NEVER fail to be correct, not even once. This provides the basis for a theory being the sound and solid foundation for describing nature, and is why there are only two real theories in physical science (owing that all others can be derived from the two): the Theory of Relativity for gravity and 'big' motion, and the Theory of Quantum Mechanics for energy. Both have stood up to every test science has ever subjected them to – every last one. Together, they describe everything in nature. To date, they have passed all tests with impeccable accuracy.

To be absolutely clear, the Theory of Relativity and the Theory of Quantum Mechanics are as close as we, or anyone, has ever come to specifying what is really true about physical reality. For now, as has been the case for about a century, nothing is truer. Naturally, any genuine pursuit of natural truth must begin with both theories. And, any valid description of truth MUST, correspondingly, be consistent with each theory, in order to be true, or to be as close as we or as anyone can EVER come to accurately specifying what is universally true in nature. Thus, we are left with only two 'true' theories for describing physical reality (all of it there is, energy and gravity encompassing everything existent), relativity and quantum mechanics. Recognizing this, we recognize that each can lead to or substantiate other theories, like, for example, the Theory of Evolution, and likewise, that each may be just generalizations of more fundamental descriptions like String Theory or quantum gravity.

The science of physics, like any discipline, can be a time-consuming labor to learn and understand. This is due to the simple reality, as the chapters will serially explain, that thinking, and therefore learning and understanding, are motion, no different from the motion of our overt actions, like when we walk or talk (or read). And, just as it is required for ALL overt motion, such as walking or talking (or reading), the motion of our thoughts requires time too. Time is required to think, and, unless our understanding is innate, time is required to understand, anything, meaning that time must be spent to learn and understand relativity and quantum mechanics. But, given enough time invested, which is not that much (a few months or so), and given a meaningful description of these theories and the conclusions that they yield (this book), ANYONE (like the reader) CAN eventually learn and understand, if only in purely conceptual terms alone (and, in the case of the condensed explanation of relativity, only in the most brief, general, and summary terms) these proven theories that model and describe physical reality so impeccably well – to reiterate, ANYONE (keeping in mind that, besides being willing to read, one is willing to likewise accept the validity of scientific fact and the truth that this fact reveals).

That is the intention of this book (among many), to educate anyone in the principles of modern theoretical physics. In particular, the text was designed for those individuals with least access to the means, material, and resources necessary for gaining such an understanding (e.g. poor, disadvantaged people). Anyone, even the most un-informed or least formally educated, if they read the text enough times (provided that they read the whole book FIRST [this, reading the entire text first, is critically important, and includes, *in particular*, reading the short Glossary*, hopefully *before and after* reading the chapters], then rereading it [easier the second time]: rereading the long paragraphs

* - Reading the Glossary is essential, because many of the definitions contained in the Glossary vary greatly from definitions of the same terms found elsewhere.

if necessary, repeatedly, and, of course, reading the footnotes – they are important), should ultimately grasp the ideas and concepts underlying the two physical theories (relativity and quantum mechanics), upon which all theoretical physics is built. To put it bluntly, anyone can, at least in summary fashion, learn and understand just what this book is trying to teach – again, ANYONE. And 'anyone', includes the reader. Should modern culture ever recover from the folly of its misplaced arrogance and its achievements somehow manage to survive modern perils, then someday school children will begin their studies of geometry using relativity (by simply understanding how light's speed never changing explains gravity), and initiate their explorations of science with at least a conceptual introduction to the ideas that underlie quantum theory (like the discrete nature of waves, or the lack of paradox in quantum theory, or, perhaps most notably, nature's necessity for life to observe it and why, as well as the fallacy of and lack of meaning existing in alternatives).

In short, if you can read, you can understand the content. Convinced that it is really possible to gain an actual understanding of theoretical physics, it only remains to be adequately motivated to make the appropriate effort by investing the time it takes to learn. Doing so one begins to understand why these theories are, indeed, why they must be, true. In other words, if the reader does indeed accept, and in so doing, 'believes' in their heart that it is truly possible to really understand the two theories (faith in one's own capacity for understanding is an absolute must), accepting what they reveal about the nature of reality, then the reader need only 'want' badly enough, to spend the time necessary (which may vary from individual to individual) reading, slowly and carefully, and, most importantly, taking the time necessary to think, contemplating thoroughly the concepts that the words reveal (haste fails). By taking the time required, and by understanding that it is indeed possible for anyone who can read to do so, one can begin to understand the very foundations upon which all real science is ultimately based, and thus realize that any science that is not consistent with physical theory either someday will be, or instead, be recognized as having never been a 'real' science (as truth's pursuit), in the first place.

So, in order to begin to develop a true understanding of physical existence, we must make one, tremendously important step. That step is to ignore everything (which means precisely that, 'everything') that we might intuitively believe or presume being true about physical existence. We must ignore our intuitive beliefs and assumptions (unless they agree with working theory), because that is precisely what one absolutely must do in order to genuinely grasp the principles that underlie nature. Indeed, the history of physics is a history that, at each step, and with each of its new achievements, demonstrates that our conventional, intuitive notions are far less than truthful; that is, except for a single such notion that all of us can hardly avoid having, namely the notion of how two straight lines can be perpendicular to one another.

In ignoring ALL the other intuitive notions that we might have, we can start with this single notion of perpendicular, and build upon it. By understanding this simple, commonplace concept, one has the necessary foundation to imagine geometry (as an organized labeling system for a set of distances and directions). And, utilizing, by imagining, geometry alone, one can understand in general though nonetheless unambiguous and most importantly accurate terms, just how these theories (relativity and quantum mechanics) work, and precisely what they say about the character of nature and those things constituting its phenomena.

Now, in ignoring every last notion we might have about physical reality – except, of course, the single notion of perpendicular – we must replace such notions with altogether 'new' ones. This, however, is not as

simple as it might, at first, seem to be. For, upon incorporating new notions into our thinking, we must start thinking in what may be wholly unfamiliar ways. Unavoidably, this is what we must do (that is, think in what may be wholly unfamiliar ways), in order to think in the altogether new ways that we must in order to begin building a 'true' understanding of nature, because that is exactly what learning theoretical physics is.

Thinking, in completely new ways altogether (ways which may flatly contradict 'old' and very fundamental ways) is the price that we pay for understanding. We **MUST** be willing to pay this price, or we will understand little at all; our intuitive notions, just like our preferences for how the world 'should' or 'must' work, will stand between us, and what is genuinely true about nature, no less than they did throughout the history of our physics – until about a century ago, with the discovery of two very, very important sets of ideas: the Theory of Relativity, and the Theory of Quantum Mechanics, both of which are the subject of this book.

Finally, there is one last thing that the reader should also consider, especially if one is not so convinced that an understanding theoretical physics is as easy to gain as is stated, or should one lose their motivation to finish reading the whole book first. (Skip parenthesis if necessary; and remember: grasping relativity is the biggest conceptual step that one must make.) But, if all else fails and interest wanes, then (provided that you have made it through the first chapter, which is only five pages long) go to the final chapter (page 110), read it first, and then start reading the chapters in reverse order. This non-sequential, reverse order happens to be an equally valid order – provided one reads the entire book. There is no need to grasp details upon the first reading; it is only to realize that there is a whole and complete picture, a grander picture that spans more than just the three dimensions that we see at any given moment. Physical existence extends far, far beyond any conventional notions that we might have about natural extent, and is so much richer than any imagination could ever conjure that no imagination can, except through a single means: the most rigorously disciplined thinking attainable, that of natural science, the human pursuit of natural truth. Although time, thought, and effort must be made to begin to understand nature as science does, the view, once attained, is absolutely stunning to all who behold it, and again, as stated, all (again, meaning anyone) can.

Author's Note Regarding Prerequisite Education (One Needs Very Little Beyond Knowing How to Read): If, at this point, the reader still finds that they still mistakenly believe that a summary understanding of theoretical physics is beyond their capacity for acquiring, then they should flatly, be assured, that in reading these words and understanding what they mean, the reader is clearly demonstrating that it is not – while believing otherwise assures such being the case.

The fact that one needs no prerequisite training for understanding is best demonstrated in the very author's lack of formal education in the subject. Though the collaborator held graduate degrees in both physics and mathematics, the author completed only a single (first) semester of calculus, and never took any physics course whatsoever, not even in the public high school from which he proudly never graduated formally.

So, should the reader believe their self unfit to learn the ideas described because they believe that they lack prerequisite understanding, they need only consider that the author's lack of it clearly renders any such belief false. Again, the author never attended any formal instruction beyond books, that available on the Internet,

and some amazing tutelage from a handful of conscientious, brilliant, and extremely well educated advisors. The reader can be assured that if he or she has understood what they have read so far, then they are fully capable of learning and understanding the fundamentals of theoretical physics that are described herein, no less than the author (eventually) did too (although a dictionary may be required - be sure to take the effort to have one at hand and most importantly USE IT, anytime that it is necessary). The understanding that is gained is really worth the effort that must be made (by both reading and thinking deeply) to acquire it, unquestionably. And this understanding of nature once gained, can last an entire lifetime; constantly enriching that life in altogether new ways that themselves may be capable of being understood only upon possessing these new ways of thinking, thereby compounding the rich benefits gained even that much more as well as in ways that are certain to surprise anyone who is genuinely intellectually curious about how nature truly operates at its most fundamental foundations and why. Indeed, understanding nature accurately and deeply can be a source of abundant joy for anyone whose wish is to simply take pleasure in finding their self existing, as anyone cannot help but do, by simply finding oneself being alive.

To the unpracticed, this can be very dense reading, so a great deal of patience may be required, especially for those unaccustomed to scientific approaches. A genuine effort may need to be made; but, it is strongly recommended that the reader please try to make that necessary effort, so that they can eventually come to enjoy the depths that theoretical physics explores and the rich beauty it so elegantly reveals. Never cease forgetting that anyone who can read can come to understand it accurately, provided they really want to, and are equally sincere in accepting the validity of its most revealing conclusions about the character of our existence, by understanding that this validity can be physically demonstrated, irrefutably.

Regardless of what those outside science (and, human nature and ambition being what it is, a small compromising minority lying within it being compensated by others outside) might try to promote for the sake of their own wholly personal agenda a distrust in science, do not worry about questions of validity. Within genuine science, there flatly exist none regarding that of either relativity or quantum theory. The confirmation of the standard model of particle physics by the detection of the Higgs boson eliminates all doubt. Theoretical physics (to the depth that it is covered in the text here) is irrefutably true scientific fact. It's just as true as cell phones, lasers, televisions, computers, communications satellites, microwave ovens, and any other technology at all that is dependent on or based upon anything electronic (including by implication, almost any modern biological innovation whatsoever) are, because theoretical physics is precisely the reason why such 'practical' tools even exist at all.

To state matters, as clearly and accurately as they can be stated, without theoretical physics, NONE of the aforementioned – not a single one, with no exception – would even exist, except as science fiction fantasy, but unquestionably, not in actual fact in any physically real way. Luckily, we do have theoretical physics in our modern world – at least for now – because enough people recognize its absolute importance in keeping our modern world modern, by keeping it civilized, through a widespread understanding of modern science and of its unprecedented impact and influence upon our progressively smaller and ever more fragile world.

EXPLAINING NATURE...

“To prefer mystery over understanding is to prefer ignorance over wisdom.” –Unknown

WARNING ADVISORY

READ ALL OF THE FOLLOWING VERY CAREFULLY BEFORE PROCEEDING!

THE READER SHOULD BE ADVISED AND FOREWARNED THAT THE MATERIAL CONTAINED WITHIN IS CAPABLE OF OFFENDING RELIGIOUS, SPIRITUAL (BOTH GOOD SPIRITS AND BAD), METAPHYSICAL, PHILOSOPHICAL, AND/OR OTHER FAITH-BASED SENSIBILITIES. THIS IS UNAVOIDABLE BECAUSE THIS IS A BOOK ABOUT PHYSICAL SCIENCE, WHICH UNAMBIGUOUSLY MAKES NO OBSERVATIONS EVER IMPLYING THE PARTICIPATION OF ANY OF THE AFOREMENTIONED IN THE WORKINGS OF NATURE. SO, SHOULD THE READER BE OFFENDED BY THE FACT THAT SCIENCE EXPLAINS NATURE IN A LOGICALLY CONSISTENT AND MEANINGFUL WAY WHILE MAKING NO USE WHATSOEVER OF RELIGION, SPIRITS, AND/OR METAPHYSICAL OR PHILOSOPHICAL PRINCIPLES, THEN SAID READER SHOULD SIMPLY IGNORE OR NEATLY DENY THE SOLID FACTUAL AND LOGICAL BASIS UNDERLYING SCIENCE; AND INSTEAD, RELY UPON OTHER KINDS OF UNTESTABLE AND UNOBSERVABLE "PROOFS" BESIDES THOSE THAT ARE READILY DEMONSTRATED IN A PRECISE, PREDICTABLE, AND REPRODUCIBLE MANNER AS ARE THOSE OF SCIENCE. FURTHERMORE, ANY ADULT READER OFFENDED BY SCIENCE AND ITS CONCLUSIONS SHOULD NOT READ A SINGLE PAGE OF THIS OR ANY OTHER BOOK HAVING TO DO WITH THE VERY TOOL RESPONSIBLE FOR ALL THE WONDERS OF THE MODERN WORLD (LIKE, FOR EXAMPLE, A LIFE EXPECTANCY THREE TIMES WHAT IT WOULD OTHERWISE BE WITHOUT SCIENCE, OR THE ACTUAL LIKELIHOOD OF SURVIVING CHILDHOOD, OR WOMEN SURVIVING CHILDBIRTH), AND, HOPEFULLY, PURGE FOREVER FROM HIS OR HER MIND ANY THOUGHTS THAT THEY MIGHT HAVE HAD OR EVER MAY HAVE OF LEARNING SCIENCE'S RIGOROUSLY TESTED MODEL THAT DESCRIBES NATURE – ALL OF IT, WITHOUT EXCEPTION – FAR MORE ACCURATELY THAN ANY OTHER BODY OF IDEAS EVER CONCEIVED. APPROPRIATELY, THEY SHOULD FIGHT WITH 'HEART AND SOUL' TO ERASE FROM THEIR MIND FOREVER THAT SCIENCE AND IN PARTICULAR ITS FOUNDATIONS, NO LESS THAN THE GREAT BODY OF ACCURATE TRUTHS THAT IT HAS – SO OFTEN AT THE PRICE OF ENORMOUS LIVING SACRIFICE (e.g. THE INQUISITION) – MANAGED TO REVEAL, EVEN EXIST IN THIS WORLD. THIS IS BECAUSE, MOST SADLY, ADULTS OFFENDED BY OR AVOIDANT OF SCIENCE MAY BEST SERVE ALL BY EMBRACING A WAY OF THINKING LEADING INSTEAD, TO THE DISEMPOWERMENT THAT *NOT* LEARNING SCIENCE MORE OFTEN AFFORDS; IN THAT WAY THEY CAN MOST ACCURATELY REPRESENT THE GENUINE CHARACTER

... proceed to next page 

WARNING ADVISORY (CONTINUED)

OF THOSE WHO SHARE THEIR PERSPECTIVE, AS WELL AS CLEARLY AND UNAMBIGUOUSLY DEMONSTRATE TO ALL WHAT THE VERY REAL CONSEQUENCES OF CHOOSING TO EMBRACE THIS CLOSED, UNYIELDING, AND PAROCHIAL WAY OF THINKING ACTUALLY ARE (AND CAN BE FOR ANYONE ELSE SO CHOOSING).

PLEASE NOTE THAT THE WARNING SPECIFIED ABOVE AND ON THE PRECEDING PAGE IS POSTED SO THAT THE READER CLEARLY RECOGNIZE THAT, UNLIKE FAITH, BELIEF, AND NON-SCIENTIFIC PRINCIPLES, WHICH ARE ALL INCAPABLE OF EVER BEING TESTED IN ANY KIND OF CRITICAL WAY, AND THAT CAN BE EASILY ALTERED, REPLACED, OR IGNORED, FROM ONE MOMENT TO THE NEXT WITH ONE'S TRANSITORY WILL OR COM-PULSION, A SCIENTIFIC UNDERSTANDING OF NATURE BASED UPON SOUND REASONING AND UNQUESTIONA-BLE ACCURACY, AN UNDERSTANDING THAT DOES NOT ARBITRARILY CHANGE BUT IS CAPABLE ONLY OF FUR-THER REFINEMENT, ONCE ACQUIRED, IS NOT EASILY, IF AT ALL, EVER LOST; VERY OFTEN LASTING IRREVOC-ABLY FOR THE DURATION OF ONE'S ENTIRE LIFETIME. THIS IS BECAUSE THE APPARENT STRENGTH OF STEAD-FAST (e.g. "UNSHAKABLE") FAITH BECOMES PLAIN ABSURDITY IN THE FACE OF EMPIRICAL, SCIENTIFIC SCR-U-TINY, AND CAN PREVAIL ONLY IN ITS ABSENCE; WHICH IS WHY THE INTOLERANCE OF CRITICAL SCIENTIFIC IN-QUIRY IN GENRAL IS SO COMMONPLACE IN THE ABSOLUTENESS OF OBSTINATE, UNYIELDING, AND UNASSAIL-ABLE RELIGIOUS, PHILOSOPHICAL, AND/OR METAPHYSICAL DOCTRINE THAT INESCAPABLY REQUIRES ITS CENSORSHIP, ALTERATION, DENIAL, DISREGARD, AND/OR FLAT DISDAIN, OR, DECEITFULLY, THE MANIPULA-TION OF SCIENTIFIC FACT, OBSERVATION, AND/OR CONCLUSION, TO THE END OF IMPLYING THAT FAITH-BASED PRINCIPLES (e.g. CREATION) SOMEHOW ACTUALLY AGREE WITH GENUINE MODERN SCIENCE, WHEN, IN AC-TUAL, PHYSICAL FACT, NONE AT ALL DO AGREE WITH ANY, EVER. ANYONE SO STATING MUST FLATLY LIE, *EVEN IF IT IS WHOLLY UNKNOWINGLY* DUE TO CHILDHOOD INDOCTRINATION OR FOR OTHER EQUALLY COM-PELLING REASONS, IN ORDER TO SO CLAIM. SUCH CLAIMS HAVE NO BASIS AT ALL IN ACTUAL PHYSICAL FACT AND ARE GENERALLY MADE BY PEOPLE WHO EITHER LACK ADEQUATE UNDERSTANDING OF NATURE AND ITS FORMAL SPECIFICATION AND DESCRIPTION, OR, SHOULD THEY REALLY POSSESS GENUINE SCIENTIFIC KNOWLEDGE AND UNDERSTANDING, MAKE SUCH CLAIMS FOR THE SAKE OF COMPENSATIONS THAT SELF-SERVING POLITICAL AND/OR FINANCIAL MOTIVATIONS ARE EAGAR TO GIVE TO UNPRINCIPLED, COMPRO-MISING SCIENTISTS WILLING TO BETRAY THE VERY ENTERPRISE PROVIDING THEM SO TOLERANT A WORLD THAT THEY CAN ENDEAVOR TO MAKE SCIENTIFIC MISUNDERSTANDING AND IGNORANCE MORE WIDESPREAD, AND AS A CONSEQUENCE, REDUCE CAPACITY FOR TOLERANCE ITSELF, BY ASSAULTING IT THROUGH THE PROMOTION OF BELIEF, *MISREPRESENTING* SCIENTIFIC FACT, TO EVERYONE'S OVERALL DISADVANTAGE; WITH THE GOAL BEING ITS REPLACEMENT, BY THE SIMPLE-MINDEDNESS OF FAITH, ALL FOR THE SAKE OF FLEETING POLITICAL AND/OR FINANCIAL GOALS, OR, IN SOME CASES, FOR NO MORE REASON THAN THAT OF MERELY HAVING THE CHANCE OF GETTING A DATE, OR THE HOPE OF MAYBE KEEPING ONE, ONCE FOUND.

"We are complexity, trying to see* deeply into this elusive thing called simplicity, which is the foundation of all complexity."

Chapter One

FOUNDATIONS

How do we explain physical reality? Where do we start, and with what do we begin, in order to take even the first step toward an explanation? Given the amazing marvels of the modern world and the unparalleled advancements in so many different sciences, it would seem that much of how the world operates and even its origins, are now explained. What is the core of that explanation? Does it explain why anything even exists in the first place? Can why even be answered? What does such a question mean, anyway? Could a fitting answer to it, a true one, exist?

In explaining physical reality, do we really have anything else, except it, with which to initiate that explanation? Is there ever anything else, except physical reality? We might think that there is more, perhaps by believing that our thoughts, memories, feelings, or dreams exist, somehow independently from physical reality. In so believing, we ignore that we cannot even 'imagine' anything independent of physical reality (though we might, quite mistakenly, believe otherwise), any more than we can think, feel, or dream independently of it, because physical reality includes even the motions of our very thoughts, memories, feelings, and dreams, themselves, which, to be clear, are ALL also, just as physical – every bit as much – as *anything* in the universe. To even consider, legitimately, that our thoughts, memories, feelings, or dreams are somehow nonphysical, one must first identify precisely what it means for them, or for anything, to be so, and how, being nonphysical in character, they nonetheless express themselves in the most overtly physical ways – like in our speaking of them, for example – that, so clearly being physical motion, makes all of our thoughts, memories, feelings, and dreams no less physical than any overt human action or personal intention (it being a thought) is; no less than ANY other kind of physical motion whatsoever in the universe is. Stating matters as unambiguously as they can be stated, anything at all that we might ever imagine being nonphysical affecting reality simply does not exist, physically – nor can it ever** – (if, for no other reason, simply by virtue of definition alone). (Note that nonphysical is considered being synonymous with the term, metaphysical, also, as there exists no *physical* distinction expressed between the meanings of the two; that is, to state matters clearly, what applies to one, applies to the other; hence the same lack of physical meaning corresponds identically to each term.)

So, because *physical* reality is all that we really have (since, as stated, anything else cannot ever be expressed, described, or manifest in any other way except a *physical* one), we must choose physical reality's observation as the first step toward its explanation. If we do not choose its observation as a first step, then we must choose either not to explain physical reality, or choose something 'else' by which to explain, though there

* - The term "see," as it is used here, implies the extrapolation of formalized abstractions of the relationships existing among the fundamental components of nature.

** - In this sense, mathematical truth has no physical existence apart from the shapes corresponding to its symbolic representations existing in our cerebral cortex and wherever else it might lie, within the brain. Thus ANY and ALL information is purely physical, even that constituting mathematical structure itself.

seems to be nothing else that we can use that is not its observation, by which to do so. If our goal of explaining is sincere, then we will readily recognize that if we choose the latter, that is, choose something ‘else’ besides observation, for explaining, we choose something that cannot, of course, ever be observed at all, not even indirectly (although we are certainly free to ‘believe’ otherwise, that is, in a modern world where the restriction of inquiry is wisely restricted, for the sake of keeping it so). In choosing reality’s observation, we choose something that we cannot really even imagine outside of the physical terms of the observations (or any permutations thereof: like allegory, for example) that are an outcome of our life experience or rearrangements and distortions of such experiences (as innate interpretive responses to these observations, with ‘innate’ meaning as a consequence and outcome of our cognitive biology), which are still all physical observations, as explained above, but our only basis.

By choosing observation as the first step toward explaining physical reality, we implicitly assume that physical reality is ‘made’ minimally, of what we observe, even if what we observe consists (as stated) only of what we think, remember, feel emotionally, or dream. We further assume that physical reality, besides being made of all these things we observe ‘within’ ourselves, is made also of all those things that we observe outside of ourselves, through our sensory awareness (our physical senses). Thus we begin, by assuming that physical reality is made of all things observed, be they observed internally or externally, directly (like seeing the print on the page that you are now reading) or indirectly (like seeing the reflection of ourselves [or anything], looking into a mirror, or looking at a recorded image). In this way, we can use physical reality as a first step, so that it can explain itself, through our embracing its observation, in the most rigorous way that we can. We will use physical reality, along with that part of it that is our imagination, as precisely as our current understanding allows, for describing our very observations themselves and the relationships* existing between these observations (in a predictable and reproducible manner), **which is what any meaningful explanation of physical reality must do**, for it to explain anything that is genuinely, meaningfully real (that is to say, *physically* existing outside of our imagination). In a word, that is our goal here, to *explain* (meaning explain reality’s physical existence itself: nature; and to be very, very clear, ‘nature’, as it is being used in this chapter and as it will be used throughout the rest of the text, is a synonym for the word “everything.”)

Having chosen to explain physical reality and its existence (again, nature: everything) using our imagination and in terms of our observations, we must next choose a method, one that renders observations consistent with those that we imagine, through our explanation. The method we will use is ‘logic’. Logic is the method that science uses. It is the method that we will use too, because we observe that logic yields the greatest consistency, between that which is imagined to be true, and that which is actually observed to be (again, existing outside of our imagination). Logic includes mathematics, but we will avoid altogether using it (directly).

But, choosing logic as our tool is not enough. We must still assume more, since our previous assumption of observation’ (above and on preceding page) fails to provide any suitable basis for using logic. We **MUST**, therefore, assume that certain ‘other’ things are true, because logic has meaning only with respect to a (set of) minimum assumption(s) of truth. Independently of minimal assumption, logic yields no conclusions. This leads us to ask, what do we assume, minimally, about physical reality, upon which to base the logic that we can use to explain it?

* - It is these very relationships themselves that constitute the ‘substance’ of scientific truth – **it is explanation** – and indeed, as quantum theory implies, the substance of reality itself (not to mention that these relationships also constitute what is, to be clear, the intended substance of the content of the text itself, as well).

Naturally, we must first consider the most readily observable, and hence, the most obvious of truths. We must assume two clear certainties. They are the certainty of our own existence, as our awareness of existence itself, and the certainty of the existence of the universe, as that of which we are aware. Clearly, we exist, and, just as clearly, the universe does too. However, stating these two truths simply states the obvious: we exist, and so does the universe; we seek to explain why. So how can we use these two blatantly obvious truths to further our understanding of either what we are, or what the universe is? How can they bring us any closer to specifying in real, physically meaningful terms, just what ‘reality’ (every last thing existent, including space and time) ‘is’?

In and of themselves, the assumption of our own existence and that of the universe’s existence make no inferences whatsoever about the relationships existing between any of our observations, which is, as was stated above (top), what a meaningful explanation of physical reality must do. It only implies that our own existence seems to be (according to what we are assuming) unambiguously differentiable, from the existence of the rest of the universe. Beyond the implied assertion that one is not the other, saying that our awareness of the universe is one thing, while the universe itself is another, says little else about the observations that we may make, nor does it infer any relationships existing among these observations, besides implying, through our use of the word ‘existence’, that we can expect to continue making observations into the future, just as experience has shown us we (as our imagination) remember making them in the past.

Because these two assumptions (those of the universe and our awareness of it existing, exists), in and of themselves, explain so little, we will have to assume more. To this end, we must seek assumptions elsewhere. We will seek them where our observations reveal that we are most likely to find *true* ones. We will seek them in the realm of ideas that is science, which tries to do that very thing, seek out *true* assumptions upon which to base its conclusions, thereby identifying those which are true from those which are not, by physically testing the validity of its assumptions in a predictable, reproducible, and precisely specified way. *The strict, demanding rigors by which it tests itself makes science (real science) the very pursuit of truth, in its sincerest expression.* Anything ‘else’, or anything contradicting (real) science, is the pursuit of something else altogether distinct, but certainly *not* truth.

In being the pursuit of truth, science seeks meaningful explanations for that which is real, meaning that science seeks to explain physical existence itself (just like we are trying to do in this book). In its pursuit, science has found two extremely meaningful explanations. In other words, these two explanations provide greater consistency, between that which is imagined, and that which is observed, than any other explanations ever known.

The first of these two explanations is the Theory of Relativity. The Theory of Relativity explains the geometry of time, space, and gravity in the universe, since, according to relativity, time is as much a part of the geometry of the universe as space is, with gravity as their outcome. Relativity is, unquestionably (of course, unless someone can prove otherwise), the most accurate description of gravity there is. The part of the Theory of Relativity that describes gravity is named ‘general relativity’. Given its impeccable performance whenever it is tested, we can, quite safely, assume that it is true (adequately, for our purposes [i.e. *measuring* space and time]). **Note:** It should be added here that, according to (general) relativity, time and space are purely structural qualities of that within them and therefore are absolutely never independently self-existent. What this means is that space and time indeed do not exist on their own and in this sense *are* “nothing”; but, to be clear, a nothing filled with quantum energy.

The second theory that explains physical reality is the Theory of Quantum Mechanics. The Theory of Quantum Mechanics describes everything lying ‘in’ the space, time, and gravity, which the Theory of General Relativity describes so well. The Theory of Quantum Mechanics describes anything and everything in the universe, except (as yet) gravity. The anything and everything in the universe that is not gravity is termed by science, ‘energy’. Quantum Mechanics describes energy, better than any other working (i.e. testable) model that has ever existed. These two theories alone embody *all* modern theoretical physics (all deeper theories derived from the two). Together, they are its foundations. And, in the realm that is epistemological thought and its application, that is, science, these foundations are absolutely the most sound and solid that there have ever been, or could ever *logically* be (notwithstanding always, a better theory).

Now, in order to understand the two theories that we are assuming to be true, we must understand a fundamental mathematical concept called ‘geometry’. Understanding relativity and understanding quantum mechanics absolutely requires that we understand what geometry is, even if that understanding exists in purely in conceptual terms alone. This requires that we understand a simple single thing, a thing that we call ‘dimension’. Understanding what a dimension is, is essential for grasping geometry conceptually, as we must do to in order understand both relativity and quantum mechanics conceptually. And, we must do this in *four* dimensions, though this is not as difficult as it might, at first, seem. There are “tricks” for simplifying the complicated, thereby making the intangibly abstract clear and easy to grasp. We will use these tricks, to great effect, as will be discovered.

Since we are assuming that relativity is true, we can explain dimension by utilizing an assumption that is implied by relativity, and accordingly, implied to be true by our assuming that the Theory of Relativity is. Thus we will assume that inasmuch as dimension distinguishes, and thereby ‘organizes’ events, any dimension is the same as any other. Time, in this sense then, is no different from space, and so we shall assume. We will assume that each is a manifestation of the same ‘thing’ – a thing that we call dimension.

Dimension can be described precisely, in mathematical terms, but, because we are utilizing descriptions exclusive of any such terms as much as is possible, we will only describe dimension in conceptual ones. To understand dimension, conceptually, we only need to recognize what a dimension is, in terms of how we see the dimensions of time and space everywhere around us, locally (when – and where – we are ‘at rest’, by not moving [by not accelerating]). In every direction, a single dimension is a straight line that is perpendicular to all other dimensions, as straight lines. Any direction, as a straight line, in the three-dimensional space surrounding us, is always perpendicular to two other lines (directions) in space, meaning that three perpendicular lines, each of which is perpendicular to the other two, like the three lines forming the corner of a room (like your classroom or any room), define three-dimensional space (in the sense that three mutually perpendicular lines are the maximum number possible within three dimensions). Time, which we are assuming to be a dimension no different from space, is, therefore, a line perpendicular to any three perpendicular lines in three-dimensional space.

Time being a line perpendicular to any three perpendicular lines in three-dimensional space means that time is a line perpendicular to each of the three spatial dimensions; difficult as such a notion might be to truly imagine. The dimension of time, therefore, in four dimensions, is a *fourth* line perpendicular to *anything* in three-dimensional space. (More generally, as will be the case for something moving in the discussion of relativity, the

lines need not be *perpendicular*, only *linearly independent* from one another, which means that no line can lie in a plane created by the other two, nor lie in a space created by the other three.) And, although time and space may appear, due to the nature of our existence, to be two completely different things, physically (the former being motion, the latter being spatial distance), as we are considering them, they are not. We will assume that they are, instead, the very same ‘thing’, irrespective of how much we might be inclined to believe otherwise, because the motion of the universe makes it appear so convincingly to us that time is a completely different thing altogether, from space. To be clear, we will assume that it is not

Aside from understanding geometry by recognizing what a dimension is and recognizing further that time is a physical dimension no different from space, to then next understand quantum mechanics, we must add to this concept of geometry yet a single other idea, namely, that of *infinity*, in the form of an ‘uncountable’ (continuous) number of elements, which, by virtue of corresponding to *different* measures (measured values), leads to another corresponding idea: that among these infinities, there exist *some that are ‘bigger’ (to be precise, ‘infinitely’ bigger) than other infinities* are (mathematically [because they are ‘measured’ in a *different* way, from simply ‘counting’ them, sequentially, one by one]). (Furthermore, one such infinity, plus another, equals a larger [‘bigger’] infinity.)

Assuming that both the Theories of Relativity and Quantum Mechanics are as true as the certainty of the existence of our awareness and that of the physically real universe are, the chapters that follow will describe how the universe operates, starting with a very brief description of those aspects of relativity that we will apply to the more in-depth discussion of quantum mechanics. A summary understanding of relativity will explain the geometry of space and time (which, for most, may seem to contradict what might be our intuitive notions about them). Relativity’s description of space and time provides the conceptual framework for specifying the character of the tiny world of the most fundamental constituents of all in nature, which is the realm of quantum mechanics (and perhaps, the realm of an even deeper theory still).

The chapters that follow will show you how and why these two theories characterize our universe. They will ultimately describe the physical nature of our very awareness, and explain the significance of its participation in creating this everything we call ‘existence’. Most importantly, these chapters will reveal the ‘reason’ why we and all other life, and the universe, even need to exist, and what ‘purpose’, if there is one, each must ultimately serve. Thus we begin, starting with the classical reality of relativity, which must be understood *first*, because an **understanding of relativity is absolutely ESSENTIAL**, for developing a *true* understanding of quantum mechanics, the latter being apparently the truest ‘explanation’, the truest model of reality, that there is (notwithstanding quantum gravity or string theory, but recognizing that quantum mechanics [like relativity] may, very legitimately, be the generalization of both [which is to say that at measurable scales, either quantum gravity or strings would “look” just like both quantum mechanics and relativity]).

AUTHOR’S NOTE: It is highly recommended at this point that the reader skip ahead to the short, three-page Glossary at the end of the book (page 148), and read it before proceeding and use it whenever appropriate as terms are introduced throughout the course of the reading. Many of the definitions found in the Glossary vary greatly from the same definitions found elsewhere.

SPACE AND TIME... (RELATIVITY)

How can a single, physical fact, that of light's speed never changing, reveal so much about nature, as to require an entire physical theory to explain it?

"To understand relativity, one need understand only a single thing:
motion."

Chapter Two

THE INSEPARABILITY OF SPACE AND TIME MEANS THE *RELATIVITY* OF SPACE AND TIME* MEASURES

IMPORTANT: If the reader has read the companion volume, entitled, *The Infinite Ocean* (which explains relativity in far greater detail), and further, understood the material contained in it as well, then he or she may wish to proceed directly to the next chapter (Three), which describes classical reality in terms of relativity's classical picture, bypassing this chapter. In doing so, the reader can be assured that all of the material contained in this chapter is covered thoroughly in the aforementioned text.

MOTION AND INTUITION (FROM *CLOCKS ON A TRAIN)**

Look around, what do you see? You see 'things', things occupying space, and with its passage, occupying time. Reality seems to be made of things occupying space, and in the process, occupying time. An additional feature of our immediate vicinity is that, regardless of wherever we may find ourselves, all these things that constitute reality, including ourselves and notwithstanding a couple of rare exceptions, seem always to be being "pulled" downward, relentlessly. Wherever we find ourselves, gravity seems as relentless and inescapable as time is. As is readily obvious, gravity 'is' the force that is constantly pulling things downward, given something "else," namely, time providing the liberty for things to change their position as a result of this force, or as a result of any other. With time, comes the capacity for things to rearrange their place in space. That is, for them to move. This is what we call, motion: things changing their position as a result of them being either pulled or pushed. We *understand* motion, intuitively; we *know* with certainty that we do, because, how could we not?*

There is yet another almost universal feature of motion that we might overlook by living in such a modern world where if, for no other reason, common, widespread understanding of the motion of planets around the sun would perhaps unknowingly mislead us to ignore this obvious feature, even though it is almost universal to all of our notions of movement. That obvious, universal feature of motion is that wherever we observe movement, it is universally, of something moving, with respect to something else, like all of the local surroundings, that is not. That is, motion seems always to occur against a backdrop of everything else that is not moving, but is instead, *stationary*. If we did not know that Earth itself is constantly moving, as humans once did not, throughout most of their history, then all motion it would seem, is with certainty, innately modeled with respect to a stationary perspective. In other words, things always, unambiguously, either change position, or do not change position, that is, either they are in a state of motion, or they are stationary. According to this innate, intuitive

* - It is highly recommended that the reader read the rest of *Clocks on a Train, Relativity - The Pamphlet* beyond that part included here, which is only the first of five parts. *Clocks on a Train, Relativity - The Pamphlet* is available for free on-line viewing, PDF download, or hard copy purchase for a nominal fee, at chongonation.org Library page.

** - To be clear about what is being said, we intuitively understand motion because we intuitively *believe* that we intuitively understand, owing that our intuition so determines.

perspective, the distinction between what is moving and what is not moving is absolute and universal. According to this perspective, absolutely nothing whatsoever can be both in a state of motion, and stationary, together, in the same moment. Moving while being stationary is unimaginable, as it contradicts the deepest, most fundamental foundations of our very reason.

This is the intuitive way that we see motion, that is, that of things moving amidst a stationary world that, itself, does *not* seem to be moving. It is clearly how we humans evolved to envision motion, something changing position amid all that does not. This is for the very simple reason that throughout the course of nearly all of human history, this simple picture has served human needs so effectively that it has brought humankind to the point of being able to question the validity of its very intuition itself. It is in this exact way that the great thinker, Albert Einstein, discovered relativity. He assumed something much more certain than common, human intuition, because he knew something about nature that humans had never known before that time, or had been capable of knowing or of even understanding, an incredibly important detail about the world that is wholly unimportant to common intuition: that detail being that *the speed of light never changes*; and because it never does, our intuition's conclusion that moving and stationary are mutually exclusive states *is a completely incorrect one*. Not only can anything be both moving and stationary, together, *everything that is anything cannot avoid doing both things together, ever.*

We, and everything else existent, are always in motion while being stationary, that is, unless we, or whatever else, are being pushed or pulled (and even then, the effects of ANY pushing or pulling aside from that occurring inside of particle accelerators can be wholly ignored). The rotation and orbit of the earth with which we are always in motion, while being absolutely stationary, prove this. To be perfectly clear, *unless we are being pushed or pulled* (acceleration or gravity, which again, we can ignore), *we are always doing both together, moving, and standing still, as it is physically impossible not to be!* But again, this is *not* how our intuition ordinarily works. It *MUST* assume that one is not the other, meaning that it *must* assume that moving things are not, nor can they ever be, stationary, according to it. If our intuition did not work as it does, by means of the distinctions (meanings) that it makes, like, for example, stationary being distinct from moving, then our ability to interact with our local world would most likely not be as effective as it is, either, and we would not be here in the first place. But, our world has grown colossally. Our intuitive picture of the world includes more: the whole universe now.

Humanity's picture of reality has expanded vastly, to encompass magnitudes more than the flat extent of local terrain that ordinarily surrounds us in every lateral direction and upon which we map our world. It is now common knowledge that earth is a planet itself, moving, by rotating, and by orbiting around a star called the sun, along with a variety of other planets that are doing the identically same thing. The 'world' includes more, far, far more, than what we evolved to contemplate. Yet we can hardly escape being forced to do so, anyway. So our mind constructs a mental picture of all this celestial motion. We represent it by the image of a set of smaller spherical bodies, orbiting a larger one, this collection of smaller systems, all orbiting, around the largest, central stellar body. This collection is formalized by the scientific term, solar system. The solar system, in turn, spins within the motion of the rotating wheel of the entire Milky Way Galaxy. We imagine the motion of this set of 'floating' bodies in our mind, in the same way that we imagine any other kind of "weightless" motion here on the surface of Earth. Naturally, this mental image makes perfect sense; because it is our very reason itself that creates it, along with the firm belief in the certainty of reason's validity, owing to the fact that it is our very reason itself that determines its own validity, *and always with great bias*. But, this intuitive mental image of motion has a failing flaw: *it persists with the idea of this collective motion happening upon an unmoving stage, YET NO SUCH STAGE PHYSICALLY EXISTS! Hence the model FAILS.* It is but one, among a multitude of many, many other intuitive simplicities, that we wholeheartedly believe (that is to say, that our

reason presumes, with unquestioning certainty, are absolutely true), **yet are all utterly and completely wrong too!**

Now we must know far more in order to understand our world and to operate even better in it, because the future of humankind and of human liberty flatly depend upon accurate understanding of nature being widespread, instead of how it is now. Widespread accurate understanding of nature is achievable only when recognition of inaccurate understanding of nature, along with the many fallacies of our intuition, become open, common knowledge instead. The effort to make such understanding as widespread as is necessary begins with the individual initiating that journey that leads to such a world to actually start embarking upon it, literally. The remainder of this chapter and the next stand wholly dedicated to bringing the reader who is willing enough to take the time and make the brief intellectual effort necessary for taking the first step toward gaining this stunning understanding that grasping relativity is, to a breathtaking vista that allows viewing what is its outcome, after it is achieved. Equally, it is to demonstrate just how easily such understanding can be acquired *by anyone*, especially by anyone who has taken the initiative to read to the end of this opening; as the current reader must have done in order to now be reading these lines. Again, anyone who can read can learn what space and time being relative actually means, and even more importantly, exactly why relativity is, indeed, logically why it must be, **a physically true fact**. Anyone who *genuinely* does care about the future will decide to make the effort that it takes in order to learn relativity.

THE THEORY OF ABSOLUTE AND UNIVERSAL, SPACE AND TIME MEASURES (THE CONVENTIONAL VIEW: SPACE BEING COMPLETELY SEPARATE FROM AND WHOLLY INDEPENDENT OF TIME, PHYSICALLY)

Space seems absolute and universal, everywhere always, at any distance, anywhere. That is, no measurement of any distance ever seems to change, under any circumstance. Regardless of the units that are used to measure the distance, once this number of units is determined, it does not seem to ever change, regardless of anything, and presumably, irrespective of any motion involved. Likewise, so seem any measurements involving a combination of distances, such as those for surface areas or spatial volumes for example. Angles established by these distances seem never to change, either. In stating that measures of distances and the angles that these distances establish seem absolute, what is really being stated is that space itself seems absolute. And, just as seems the case for distances and angles, temporal intervals, that is to say, time, seems also to pass at the same seemingly absolute rate, always, everywhere, under any circumstance whatsoever, regardless altogether of anything. No accurate clock ever runs faster or slower, under any circumstances, ever, does it not? Any clock seems to run at the same rate as any other, regardless of anything or any motion; a minute is a minute anywhere, always, under any circumstance. Is all this not true, again, always?

Another seemingly obvious fact is that although each clearly seems universal and absolute, time and space clearly seem also wholly “unlike,” meaning that each is physically distinct from the other. Space can be navigated at will, locally, in any direction, while time cannot, in any way. Time has only a single direction alone: into the future. Its march is unstoppable and moreover, absolutely inescapable. This means that we simply cannot help but be continually removed from the past: it *always* lies behind our present moment; and, in like fashion, continually removed from the future: it always lies *ahead* of the present moment. Both past and future lie beyond our reach, with the present moment confining the temporal extent of our existence to a perpetual progression of fleeting present moments that, in series, constitute our lives. Reality is accessible in no way other than our immediate moment-by-moment recollections and contemplations of it, even with respect to our recording of events). All this is clearly obvious to anyone, and a flatly indisputable fact about reality, is it not? Furthermore, what is true for us here now must be true, at any time, anywhere, must it not?

Naturally, it seems obvious that the past and future that correspond to the earth correspond also to the moon and sun, just as this seemingly absolute distinction applies identically to the solar system, and likewise to nearby stars. Extending this idea further, we realize that this seems true for the entire universe, at any distance, not matter how far. That is to say, that it must be the same time *everywhere*, because what exactly would it mean for it not to be? How? It *not* being the same time everywhere seems unimaginable. Not knowing, we might mistakenly think that so imagining lies outside of our intellectual reach, without realizing that *we would be wholly incorrect in thinking so*.

This mistaken image of universal absoluteness (along with any presumed limits upon our ability to imagine more) is best expressed as “the theory of absolute space and absolute time (measures).” It is a model that we surely cannot even remember acquiring, much less how, or why, yet embrace for lack of any viable alternative. It is a model that confines physical existence to a solitary moment in space called “the present,” with the past being always gone forever and hence perpetually non-existent, while the future lies always ahead, just as non-existent as the past. It thus gives meaning to time having begun, implying a ‘before’ and ‘after’ with respect to time’s ‘initiation,’ *while time (again, by virtue of presuming before and after ‘initiation’) was nonetheless somehow passing even though it had yet to exist*. By overlooking this critical failure or by lacking an alternative concept to replace it, one is left only with a model based upon a *gross fundamental misunderstanding* regarding the way that nature works, and most significantly, an extremely limited and *gross fundamental misunderstanding about time and space measures: that they are absolutely unaffected by motion or gravity*. And, unless we learn differently (one way: by reading the content), it is a model that we retain for our entire lives mistakenly believing that it accurately embodies the way that nature really works. This absolute and universal model is singular, simplistic, and intuitive. But again, unambiguously, it flatly **mis**represents how nature, *in actual, physical fact* truly does work* (demonstrably).

Grasping relativity can correct this mistaken model by replacing it with a model that, again, corresponds perfectly to how nature, in actual, physical fact, truly *does* work. The remaining text of this and the chapter that follows stand wholly dedicated to bringing the reader who is willing enough to take the time and make the intellectual effort necessary for gaining the understanding that comes with this new model, to that very understanding itself. It is an understanding about nature that lasts for a lifetime, as well as an understanding about nature that is, and will always remain, infallibly true.

MOTION ACCORDING TO THE THEORY OF UNIVERSALLY *RELATIVE* SPACE AND TIME**

Acquiring relativity's model of nature begins by abandoning the conventional idea of motion that almost everyone commonly possesses, and imagining motion as relativity considers it. We can do this in a very simple way: through a story, a story of scientific discovery in a world with one dimension fewer than ours, yet inhabited by creatures just like ourselves, but in particular, equipped with cognitive abilities just as powerful as our own are, in a world with the open liberty to think freely.

Imagine slowly passing a simple, solid, three-dimensional object through the surface of a pool of completely still water. Keep in mind that the surface is the *boundary* between the air and the water, and so does not include the water of the pool itself or the air. An oblong, American-style football serves this purpose well because it is a simple, (effectively) solid, three-dimensional object. As the football were to pass through the plane of the surface of the pool, it

* - It should be noted that as simple a misunderstanding as that of time having begun, can ultimately lead to other, gross — **and dangerous** — misunderstandings, in general.

** - It should be pointed out that the relativity of *time* measures means that what is past and what is future is as relative as space measures are. Put another way, prior to relativity, what was past and what was future were considered being instead of relative to motion and gravity, universally absolute, across all space at any distance, what one might legitimately call a “theory” of (universal) *absoluteness* of space, and in particular, time measures. **To be perfectly clear, the Theory of Relativity**, as the chapter explains, **specifies that time (and space) measures, like what is past and what is future, for example, are *relative* to motion and gravity.**

OTHER BOOKS BY CHONGO

...epistemology

THE INFINITE VOID, Relativity's Space and Time Without Math*

Einstein's Theory of Relativity EXPLAINED in a purely conceptual way that, just like this book, involves no formal math whatsoever.

CLOCKS ON A TRAIN, Relativity – The Pamphlet**

An exploration of the most important experiment in relativity, demonstrating the most profound and unexpected property of space and time.

...philosophy

THE QUOTABLE CHONGO (Series)

Terse expression of fact, folly, & wisdom in a collection of separate works on topics ranging from quantum theory to simply exploring how to be "bitchin."

...extreme sports (big wall rockclimbing)

COMPLETE BOOK OF BIG WALL CLIMBING *Volume One: The Ground Manual*

Big Wall Field Guides

Big Wall Leading Equipment

Advanced Big Wall Stations and Hauling

Advanced Big Wall Ropes & Rope Management

Big Wall Racking

EDUCATIONAL PUBLICATIONS BY CHONGO

...conceptual physics (in collaboration with José)

NO ACCIDENT (Formerly, *The Infinite Pattern*)

How Quantum Theory Disproves Randomness

A purely conceptual description of relativity and Quantum Theory

THE INFINITE VOID

Relativity's Space and Time Without Math

Einstein's Theory of Relativity in a purely conceptual description

AN ETERNITY OF TOMORROWS

Everlasting Life & Quantum Theory

TOUCH OF THE OBSERVER

*CLOCKS ON A TRAIN*** *Life, the Multiverse & Immortality*

...religion

HONOUR THY FATHER

Foundations of Monotheism

THE CHRISTIAN STATE

When Religious Law Rules a Nation

...philosophy (series)

THE QUOTABLE CHONGO

Terse expression of fact, folly, and wisdom, in a collection of works on topics ranging from quantum theory to exploring how to be "bitchin."

MONKEY IN THE MIRROR

DECISIONS OF NATURE ***THIS BOOK IS INTENDED TO OFFEND...***

...outdoor humor & wisdom

LOVE AND HAT AT SEA

A Book about Wall Partners

COMPLETE BOOK OF BIG WALL CLIMBING

The most comprehensive big wall climbing, instruction manual in existence on Earth

...big wall field guides

Big Wall Leading Equipment

Advanced Big Wall Stations and Hauling

Advanced Big Wall Ropes & Rope Management

Big Wall Racking

...y en español (porque Chongo lo habla, que saldrán en el año 2019) *El Oceano Infinito** y *El Patrón Infinito**

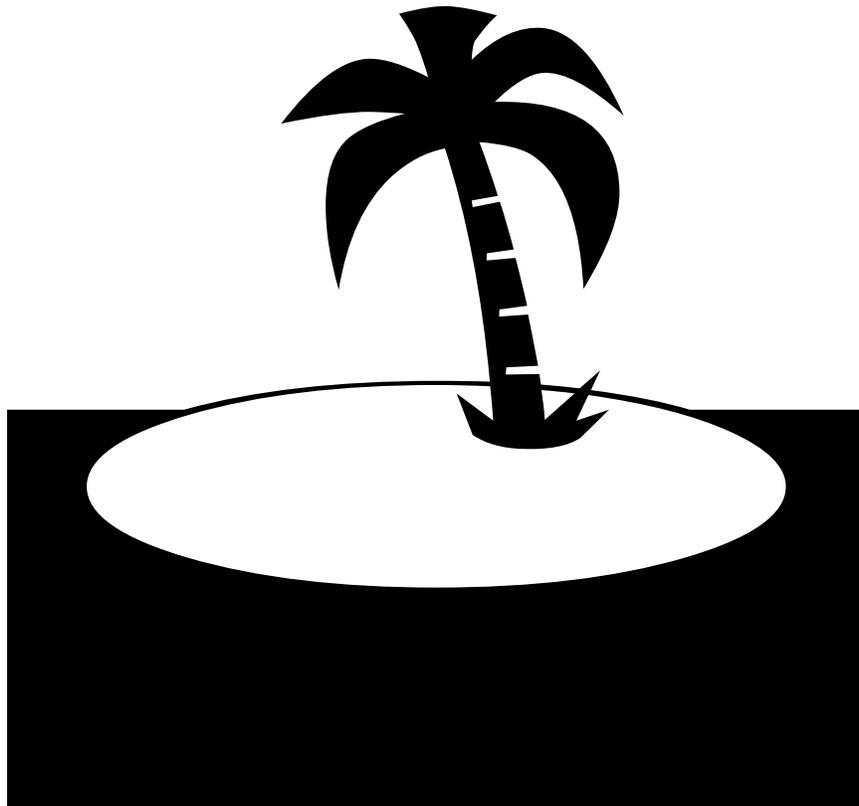
chongonation.org

...because the world needs a *real* education.

* - in collaboration with José

** - *Clocks on a Train* is FREE, on-line, at chongonation.org

NATURE
EXTREME SPORTS
HUMAN RELATIONSHIPS
CONCEPTUAL PHYSICS
TIGHTROPE WALKING
BIG WALL CLIMBING
EPISTEMOLOGY
PHILOSOPHY
HUMOR



visit:

chongonation.org

...because the world needs a *real* education.