BUDDHISM AND MODERN PHYSICS: FROM INDIVIDUALS TO RELATIONS

Volume 1: Non-Technical Summary
Paperback Edition

Robert Alan Paul

January 6, 2016

In memory of
Catherine Stephanie Wykowski Paul
1949 - 2014

BUDDHISM AND MODERN PHYSICS
FROM INDIVIDUALS TO RELATIONS
Volume 1: Non-Technical Summary

Cover Blurb

The book investigates distinctions between independent individuality and interactive relationality in physical phenomena. This is a common topic for investigation in modern physics and philosophy of science, and the topic is explored using contemporary research in those disciplines. Additionally, it is common for Buddhism to focus on relationships, and it proposes that independent individual things do not exist. In the context of physical reality, I take this Buddhist view as a hypothesis and examine it critically. We evaluate its arguments and find them generally to be problematic when evaluated against modern standards for logic and physics. However, its fundamental principle—emptiness, or shunyata—is still worthy of being tested.

Contrary to many books on Buddhism and science, this one takes a very positive view of science. Yet, this depends on how we define 'science'. Hence, the book begins with an examination of that topic, informed by philosophy of science and the author's experience and training as physicist and philosopher. While we discuss, explain and justify many standard views of science, and present the standard elements of science, physics and physics theories, the book argues extensively for one perspective: pluralism in a synthesis of the author's design.

I will show Buddhist 'emptiness' (shunyata) to be quite consistent with the knowledge framework of Physical Pluralism. When we test shunyata against the results of physics—while interpreting them within that knowledge framework—we discover the relevance, importance, and some truth in the Buddhist relationality ideas.

For nearly four decades, Robert Alan Paul has studied physics, had a career as a physicist, and both studied and practiced Tibetan Buddhism. He holds a bachelor's degree in physics, and separate master's degrees in philosophy; philosophy of science and mathematics; and physics (abd). He holds an interdisciplinary Ph.D. in four disciplines: philosophy of science, Western analytic metaphysics, Buddhist philosophy, and physics. His Ph.D. dissertation was the foundation for this book.

ABSTRACT

The focus of this book is investigation of the distinctions between the independent individuality and interactive relationality of physical, non-living phenomena as described by some interpretations of contemporary physics and Buddhism. Neither physics nor Buddhism are monolithic systems, but rather have many different schools of thought. Generally, however, Buddhist philosophy focuses on relationships more than objects, and actually proposes that independent individual physical things or independent 'external' phenomena do not exist. Some interpretations of physics propose views that are consistent with that Buddhist view.

Consistent with Western philosophy and especially physics usage, we define a phenomenon as the object of one's senses, what we detect by them and infer by our reasoning to exist separately or externally. The question remains whether there are such things independent of perception and our conceptions about them—a question that modern Western philosophy and Buddhism have examined extensively. Indeed, the modern physics of quantum mechanics and relativity has brought a scientific focus to this question also, resulting in explicit experiments exploring the relationships. Hence, we will examine this question here as a ground that must be firmed in order to talk about physical reality altogether. My conclusion is that it is reasonable to assume that such a reality exists, and we proceed based on that conclusion. However, it remains an open question what the nature of that reality might be. This will form the focus of our exploration.

A phenomenon may be an object, entity, event, interaction, process or property. Properties may be relational (extrinsic) or intrinsic. In this language, the Buddhist view, therefore, is that completely independent intrinsic properties do not exist. We will take that view as a hypothesis and examine it critically. We will work at the intersection of four disciplines: philosophy of science, Buddhist philosophy, Western analytic philosophy and physics. The focus of our study in terms of Buddhist philosophy will be *Madhyamaka*, the 'middle way'.

The Western approach is typically an attempt to understand the ultimate nature of physical reality of essentially independent physical entities and relations between them. This is the object-oriented view. The Madhyamaka view is to determine the relational interdependence existing throughout phenomena. This is the relationality view.

We will rely heavily on results from physics research. Contrary to many books in the genre of Buddhism and science, this one takes a very favorable view of science, and in particular physics. I am a

physicist with graduate training and decades of work in the field. Additionally, I have extensively studied philosophy of science as part of research for an older master's degree and recent Ph.D. research. While science does not seem to be the *only* form of knowledge, I will justify the view that if we are to have the best understanding of physical reality that we can have now then we must use the best physics knowledge that we currently have. However, we must distinguish such knowledge that we can trust from such knowledge that is tentative or developing.

We start with an exploration of the nature of science. We discuss, explain and justify the standard views and the standard elements of how to distinguish science, physics and physics theories from other enterprises and conceptual structures. However, contrary to the more commonly promoted view that I label 'fundamentalist'—that the ultimate nature of reality can be found in the most basic of physical phenomena and components—and 'universalism'—that all truths pertain universally—I rather argue for a pluralist interpretation of scientific knowledge that I name Physical Pluralism. It surprised me when I discovered pluralist physics views during research for my dissertation—I started as a universal fundamentalist—and I only slowly became convinced that a pluralist system of some sort could be valid and have factual correspondence with the physical world. I am not quite a born-again pluralist, but I do find significant justification for the view.

We must note early in the discussion that the purpose of Buddhist philosophy is to relieve suffering of all sentient beings. Buddhist teachers describe the way to such relief in teachings on a personal path. The purpose of Buddhist philosophy is not to philosophically convince someone about the nature of physical reality or to have them believe in a highly abstract conceptual framework. Rather, its purpose is to show them how we can be free of such suffering by following a personal path that generally involves learning, contemplating and meditating. The first of these three uses conceptual mind, the second uses a mixture, and the third leads us into use of other aspects of our human cognitive structures, what we might call non-conceptual awareness.

Yet, Buddhism also teaches that there are two aspects of confusion that cause suffering: (1) mistaken views about the nature of reality and (2) conflicting emotions. The Buddha summarized this view in the well-known four noble truths. We will not examine the personal path towards liberation from the suffering that is due to conflicting emotions except in a very indirect way. Specifically, if the reader is looking for guidance in her own path and struggles with emotional

conflict, the author suggests she look elsewhere. Additionally, if the reader is interested in views about the nature of mind, this book will not provide much guidance.

The major topic discussed here is the physical nature of physical reality, especially as discussed by modern science and philosophy of science. When we have an accurate understanding of that nature, then at least some of the sources of suffering may be obviated.

Some Buddhist teachers court Western philosophy and scientific knowledge, and some say that there is no basis for dialogue, due partly to the drastically different purposes and partly due to their respective non-intersecting premises. However, this is not my view, and we will, therefore, discuss the ways in which these disciplines intersect. The main intersections are that each requires we test the tenets and conclusions directly, rather than use blind faith, and each seeks the truth—'the truth will set you free'. These, I think, are sufficient for dialogue.

The first step in such a dialogue is to be open to question all of our pre-existing beliefs. We will discuss the need for empirical testing of our beliefs, and rely heavily on such testing in determining what is true. Without such empirical testing, we must rely solely on logic and intuition, yet in physics research, those have frequently failed us. The balance of these ingredients is necessary for comprehensive understanding.

Buddhism also uses logic and empirical testing. In Buddhism there are traditionally four kinds of knowledge that include (1) direct cognition, which corresponds to reliance of empirical evidence; (2) inferential cognition, which corresponds to use of logical analysis in philosophy and theoretical thinking in science. In addition, Buddhism relies on words of the Buddha and yogic direct cognition, which is personal expert testimony. We will also put much stock in such testimony by philosophers and scientists, yet *not* take it as gospel. Rather, we will question and test it against empirical findings, just as we will do the same to the relevant sacred tenets of Buddhist philosophy. Just as we now judge that Einstein made serious errors, we might have to say the same about some of the ancient Buddhist scholars and enlightened meditation masters when they argue using ancient philosophies concerned with the nature of physical reality. We have learned much in 2,500 years, which should surprise no one. None of my analysis, however, reflects on my extremely high respect, devotion and allegiance towards Buddhist teachings regarding a personal journey towards liberation from all kinds of suffering. I find them unexcelled and comprehensive.

Nonetheless, in contrast to many books in this genre and in the more general literature of Buddhist philosophies, this book does not leave the Buddhist concepts explained uncritically. This is not a presentation of Buddhist gospel. We will examine those philosophies and arguments in detail, but with the purpose to see if they are true in our context. Buddhist scholars have discussed and debated these philosophies for 2,500 years, and there have been many disagreements. We will add to the discussion.

The central Buddhist concept that we discuss and use is *shunyata*—pronounced *shun-ya-ta*. Most scholars and Buddhist teachers translate this as 'emptiness', or more accurately 'being empty of inherent nature'. We examine this concept not simply as it is explained and argued by Buddhists and philosophers of Buddhism, but also against contemporary standards of what makes logical, philosophical, scientific and physics sense. I conclude and demonstrate that many—if not all—of the standard *arguments* for shunyata as a *universal principle* in the domain of physical reality are philosophically weak, perhaps even illogical, and it is very difficult to find correspondence with empirical scientific understanding of the nature of that reality when we apply what I have called fundamentalist interpretations. When we apply pluralist interpretations, we find more coincidence.

Hence, although the ancient arguments may not hold up to what we know now—which should not surprise us—I find that there is sufficient reason to take shunyata as a hypothesis and test it against current physics knowledge. When we interpret shunyata within the knowledge framework of Physical Pluralism, and with application of contemporary standards of philosophical logic, we discover its relevance, importance, and some truth.

This ***Volume 1: Non-Technical Summary*** provides a brief introductory treatment of the topic designed for the general audience. You may read *Volume 1* independently from *Volume 2: Scholarly Edition*. Both volumes provide background and develop concepts from a non-technical and non-specialized starting point. However, this *Volume 1* stops there, while in *Volume 2* we examine extensive treatments of controversies, complexities and technical details, plus elaborate explanations and examples. *Volume 2* contains hundreds of citations and footnotes, while *Volume 1* has no footnotes and few citations, although both have complete bibliographies.

The series ***Buddhism and Modern Science*** will include books that examine links between Buddhism and the life and social sciences, e.g. neuroscience, economics, and geopolitics.

1. INTRODUCTION

A. Objects, properties, relations, processes and truth

A common Western perspective is that things populate our world. Many of those things seem to have relationships with other things, while some of them seem to stand alone, independent of everything around them. While we will not be discussing people, psychology or social interactions very much in this book, it may be helpful to start the conversation with a personal perspective. Hence, I can admit that sometimes I consider myself the center of my world. Frequently I expand my center to include close family and friends, but it is my center, my family, my friends. I think of myself as an independent entity, unique in many ways, standing alone as an individual person. Of course, I am also very dependent on others. Is this a contradiction—to be independent yet have relationships and dependencies? Does the fact that I have relationships entail that I am not independent?

I seem to be separate from every other thing and every other person, yet I have relationships with many of them. I have close ties with my family, my friends, and some of my neighbors. I own furniture and other things in my home, driveway and yard. I feel relationships with all the people and objects of our world—although many of those relationships are quite weak. I can even think of my small place in the solar system and the rest of the universe.

We use words like ‘things’, ‘objects’, and ‘entities’ to denote what populates our world. These objects have properties and relations, and some of those properties seem quite independent of other things. The flower vase in my living room is 25 cm tall, and that seems to be entirely a property of the vase itself, without relation to anything else. It is an intrinsic property. However, it is sitting on the side table in the living room, which is a relation. Many of the relationships between objects are positions in space relative to other things, and some are process-oriented. The vase sits on the table, and the fly is flitting around the room, buzzing as it goes—pesky varmint. We base many of the relationships we have on value judgments like that: I do not like the fly, the flowers are pretty, I love my family, I think many people of the world are good and others are at least confused. It is fun to drive my car, although only when the weather is good.

Do the objects of our world have as their own properties those opinions and values that I place on them? Are the objects free of all such properties? Which are their own intrinsic properties, and which are the ones dependent on or relational to other things?

This book is partly an examination of the way in which we think about our world. However, contrary to some books in this genre, I argue that there is a world that is independent of thought, and this book is more about the nature of our world than the nature of thought. We will therefore discuss the relationship between our knowledge about the nature of our world and the nature itself.

We may think, as described previously, that there are objects and some of them have relationships. On the other hand, if we transform our worldview 180^{o}, then we might start with relationships and seek their entwined portions, which may or may not include objects. The problem with objects is that we automatically begin from the idea that they are independent. This is an ancient view, the object-oriented worldview based on Aristotle and adopted by many philosophers and most people in their normal thinking. We will question this worldview and attempt to transform it.

Why bother? There is a kernel of truth in the idea that when we start with objects and people which we initially and intuitively consider as independent, then we end up centering the world on 'me'. We do this even if we have relationships and dependencies. I may expand my center to 'my' family, 'my' things, 'my' nation, 'my' religion. It is so easy to set up a dichotomy, an opposition between my world and everyone-everything else. We may look askance at those others, with suspicion or hate, simply because they are not part of our individual, me-centered identity. This can be a big problem.

This book is not about people, nations, psychology and geopolitics. It is about our physical world. I start there for several reasons. First, physics is my core competency, so I must start there. Second, if we cannot understand such simple things as physical, non-living phenomena, how can we hope to understand complexities of personalities and international relations? 'Simple', did I say? Yes, physics is very simple. One famous physicist started as an economist and gave up all hope of understanding it, focusing instead on quantum physics—much easier. The physical world is composed of very few things, and has very few relationships (there we are again: things and their relationships.). My third reason for starting with physics is that I think some of the principles we discuss in this book can help transform our worldview about people also.

The main idea of this book is to present what I have become convinced is the truth about the nature of the physical world. In conjunction with the second volume that has details, arguments, responses to objections and references, and my dissertation that has even more of the same, any reader may become convinced as well. My purpose in writing this book is because of a belief that I have, that *the*

truth will set you free. This is also a principle of Buddhism we discuss further below. If we guide our lives by what is true in the world, then we will be free of the kind of suffering that comes from mistaken conceptions about the nature of the world. This is half the journey. The other half is dealing with conflicting emotions, and while this half will assist, we leave most of that task that for others to address. Now, all we need to know is what is true.

B. Transforming motion

Let us begin with a thought experiment: you are standing on a train platform. The train you are waiting for is the local, and you see the express barrowing down the tracks. It zips by without reducing its speed. You stood still, and it sped past. Yet in passing you saw a colleague standing inside one train car. You saw that she recognized you, and she smiled; perhaps she realized that she would get to work before you. Now rewind and take the view of your colleague, who is now the first person, the 'you' of this story. You are on the express train bound for the city. You see the local platform coming towards you, and passing at high speed. As it passes, you see your colleague (the previous 'you') waiting for the local. You smile, realizing that you will arrive at work earlier than your colleague will.

Technically, there is no absolute frame of reference from which we can judge absolute velocities. Velocity (speed + direction) is relative. The train is moving relative to the platform and the platform is moving relative to the train. When you are in the train, when it is not accelerating, you cannot know that it is moving. You can play toss with a fellow passenger and the ball will not veer off due to your movement. If the windows were blacked out, there would be no test that you could perform on the train to establish its movement. We call this *Galilean invariance* named after the famous Italian philosopher and physicist. All of physics must at least satisfy Galilean invariance. There is no absolute space, time, or velocity. Rather, there are relationships, with no privileged views.

Here, briefly, is the focus of this book. I will demonstrate the limits of object-orientation in physics, and focus our attention on relationships. We will see that the relational viewpoint is more valid, i.e. has more correspondence to the actual nature of the physical world compared with object-orientation.

C. Three parts, dimensions and components

In order to proceed, I divide this book into three parts: the nature of science generally and physics in particular; Buddhist philosophy of objects and relations; and the physics of objects and relations.

C.1. What is science?

We first examine the nature of science in general and physics in particular. Science cannot tell us anything about our experience of sense pleasures—no physiology can explain the taste of a strawberry, even while it can explain the chemicals and neuroscience involved in that experience. Science can tell us about hormones and pheromones, but not about the magic of love and commitment. As is commonly attributed to Einstein, "gravitation cannot be blamed for falling in love".

Yet, science can tell us so much about our world. We will investigate the differences between science and other forms of knowledge. Specifically, we will examine if and how scientific theories can be trusted to provide truth in determining the nature of objects and relations in the physical world.

One of the main results of this examination is the discovery of pluralism in the philosophy of physics. Philosophers of science distinguish pluralism from a set of perspectives that I call fundamentalism and universalism, plus the idea of intertheoretic reduction. These perspectives examine the relationships between ideas, theories and the nature of things. Note that my use of the word 'fundamentalism' does not refer to fundamentalist religious belief *per se*, although clearly it is related. Rather we are discussing beliefs about the nature of physical reality.

(F) Fundamentalism is a particular expression of the most basic, ultimate, or final characteristics, which are—in some sense—at the foundation of our world. In particular, fundamentalism says that there is only one valid set of final characteristics of all things, based on the nature of things in a fundamental, elemental way.

(U) Universalism extends fundamentalism with the implication of a comprehensive extent. A universalist characterizes all things in one way. For her, everything has the same nature. Fundamentalism does not necessarily imply universalism, since a physical law or property may be fundamental in the sense of being the basis for construction of all things, yet still many things may not completely share the fundamental character. Universalism extends the fundamental character to all things in all domains.

(I) Fundamentalism and universalism utilize the idea of intertheoretic reduction. This is the idea that we can reduce all our theories to those concerning the most fundamental and universal principles. In physics, this idea refers to our ability to derive *all* of the laws, principles *and* properties of all entities and phenomena of all domains from the physics of the most fundamental domains. Scientists and philosophers express this as deriving theories from

first principles. In large measure, those first principles include the nature of phenomena in the most microphysics domains since they include entities that are the building blocks of all matter.

(P) *Pluralism* is a view that we distinguish from those other views in three interrelated dimensions:

(1) Meaning (semantic)

(a) Fundamentalism and universalism in meaning state that all propositions which have a truth-value, i.e. which might be true or false, have their one truth-value in all contexts. In addition, all sentences have the same meaning in all contexts. This view seems highly questionable, if not straightforwardly false, yet it is a common understanding. This view is sometimes the same as believing in an absolute truth.

(b) Pluralism in meaning promotes sensitivity to the context of discussion, and involves us with relative truth.

(2) Knowledge (epistemic)

(a) Fundamentalism and universalism in knowledge are that we can have a single knowledge framework that can provide all answers to all questions. This is relevant to physics as the search for a unified field theory: a grand unified theory of everything. Hence, fundamentalism and universalism in the context of knowledge of the physical reality is that the physics theory of our most microphysics domain describes the universal nature of all things. This is equivalent to universal theory reduction and our ability or wish to derive all physics from first principles.

(b) Pluralism in knowledge provides separate theories for different contexts. In terms of physics, we call such contexts *domains of knowledge, domains of applicability,* or simply *domains* of a particular physics theory. Domains are essentially the phenomena that we discuss, involving objects, processes, interactions, and other relationships. Each theory shares common general principles, like the conservation principles of mass-energy and electric charge, what we might call common absolute truths. However, each domain has its own knowledge base, somewhat independent of other domains. Additionally, when science changes it does not discard the old theories as much as refine their domains. We can still trust the old ideas, if we are careful about context.

(3) Being (ontic, objective, real)

(a) *Fundamentalism and universalism in being* are that all things have the same natures. This could be that all things are individual objects with intrinsic properties, and those objects may have relationships. Alternatively, the common nature may be that nothing has any intrinsic properties or inherent nature, regardless of context. In physics, according to this view we should describe the ultimate nature of things as their nature as described in the fundamental theory of our most microphysics domain. Being and knowledge are intimately connected.

(b) *Pluralism in being* shows how things *are actually different* in different domains, not simply that we can think of them in different ways, depending on our mood, or use different theories to describe them for pragmatic purposes when convenient.

In particular, fundamentalism says that we can only know what a rock *truly is* from the nature of the elementary particles that comprise it in combination with the fundamental nature of space, time, energy, etc. Sometimes there is a corollary that the nature of macroscopic things ultimately is just the nature of their microscopic composita.

I will argue against these views. However, in so doing I argue only against their exclusive use. As I point out their deficits, at the same time I refine them and integrate them into my pluralist synthesis. It is pluralist even in acceptance of non-pluralist aspects.

It is a basic principle of pluralism that there is no ultimate nature, but rather are only local natures within the contexts of different domains. At the same time, I acknowledge that there are universal general principles that apply in all domains necessarily. However, each of the general principles may apply in each domain somewhat differently. Those principles instantiate as constraints in the way different phenomena relate and interact. However, within those constraints, much is possible and the general principles do not favor one or another outcome. Thus, closed systems always conserve mass and energy separately, although to be metaphysically correct and quantitatively correct—even if in the 10^{th} decimal place for commonplace interactions—we must consider mass-energy relativistically together. There are several universal general principles.

Given those global constraints, we then need further investigation to describe phenomena in local domains. The nature of the rock is one thing when we toss it in the air, another when we smash it with a sledgehammer, and another when we slice off a piece and throw a stream of protons at it in a particle accelerator. The rock is different in nature in different interactions, even though it seems to be

the same thing. Different aspects of its nature manifest in different interactions. This is an aspect of its relationality.

Nonetheless, we will find that it has inherent natures. How we make these two views of relational and inherent natures mutually coherent will require the entire book.

C.2. Middle way Buddhist philosophy

After our discussion of science and Physical Pluralism, we will look at the Buddhist philosophy called 'middle way', *Madhyamaka* (mod-yom'-aka) in Sanskrit. The core concept of that philosophy is *śūnyatā* (shun-ya-ta'), usually translated as 'emptiness'. *Śūnya* is the root, and *ta* adds the '-ness'. Hence, we say things are śūnya, empty. Śūnyatā is the lack of *svabhāva*, which is the essence, substance, or inherent nature of things.

The view that this translation as emptiness implies is that all śūnyatā is nothingness—and nothing could be further from the truth. In fact, most Western and Buddhist scholars have rejected this view, yet have preserved 'emptiness' as the translation. I conclude that since śūnyatā is about the lack of intrinsic or inherent nature in all objects, physical and personal, we should refrain from using emptiness as its meaning, and therefore not translate it that way. We will either say 'lacking in inherent nature' or simply leave it as śūnya.

Without inherent nature, we may think that an object is empty of itself, empty of the essence that gives itself an identity. If this were the case, then 'emptiness' might be the natural translation. Then, we might think that it would be hard to distinguish the object from nothingness. However, the philosophy argues that without any inherent nature, relationships may abound. Hence, the object is not empty nothing, but rather is full of interactive relationships with its relational nature. Madhyamaka is about relationality; hence, it is something that we may use in our investigation and attempts to transform our worldview.

We will use a traditional approach to understanding śūnyatā in three components:

(1) The lack of independence in causal relationships between objects that are now understood to be inter-dependent
(2) The lack of independence in causal relationships between an object and its parts
(3) The lack of independence in relationship to time, i.e. the lack of persistence of all objects

We will not take as gospel the view that we all things are śūnya. We will examine the traditional arguments for śūnyatā in the physical world and find that they are not convincing, at the very least, in light of our current knowledge. I will demonstrate how many of the arguments

are logically invalid and/or factually fallacious. The general principle may or may not be true, but we need to find better logical and scientific justification than the traditional texts provide—if that is possible.

C.3. Physics of relationality

The third part of the book is an examination of those three components of śūnyatā based on Physical Pluralism. We examine the nature of physical phenomena from the perspective of contemporary physics knowledge. Note, that there is an enormous amount of such knowledge that we can trust to be true. However, we discover that in order to have a full understanding of the actual nature of the physical world we must permeate all our meaning, knowledge and being with relationality and pluralism.

For example, there seem to be many things that have intrinsic properties, inherent nature, individuality, independence in causal relationships, no parts hence independence in relation to parts, and that are persistent. Things or objects of our physical world with these characteristics include at least the 16 elementary particles such as electrons that we will itemize and discuss in some detail later. Additionally, it is easy to argue that the atoms described by the elements of the periodic table are have no separable parts in certain domains—the neutrons, protons and electrons are bound together in unitary atoms. We will find many more such entities, such as the neutrons and protons themselves.

These are examples of the *Unity Principle* that I explain and demonstrate fully: simply because a unity can be broken, this does not deny its unity before being broken. This principle does not apply to all things, but it does apply to many physical things in many circumstances.

However, these observations are seen with Physical Pluralism as dependent on a particular domain of enquiry—a context. In other domains, we find that each of these intrinsic properties exhibit relationality. There does not seem to be global independence in all domains—simply local independence in some domains and local relationality in others. When there is local relationality in some domains as a basis for intrinsicality in other local domains, I call the phenomena globally relational. Hence, mass is intrinsic in many domains, yet is due to interactions in other domains. Hence, mass is globally relational.

D. Debunked myths and basic principles

We will discuss each of these—and more.

D.1. Limits of science

I agree that there are limits to knowledge obtained from current science. Science cannot explain our direct experience, for example our experience of the taste of a strawberry. It cannot even explain our experience of colors—there is nothing blue in our brain, so where does that experience come from (for non-colorblind folks)? Science can tell us the chemistry of such things, but it cannot yet explain our direct experience. Someday it may be able to do so.

However, physics has provided us with an enormous quantity of knowledge and understanding about many phenomena. Not only that, but we can have confidence that a substantial amount of scientific knowledge and understanding is true and inviolable. It is simply not true that scientists dumped all of our scientific knowledge in the metaphorical trash bin when we discovered quantum physics and relativity. Most of science will not change, even with the next paradigm shift of new knowledge. That new knowledge will generally pertain to domains beyond the limits of phenomena in currently known domains.

However, many Madhyamikas consider science to provide only 'relative' knowledge, which is somehow illusory and dependent on concepts. They find ultimate knowledge through meditation when concerning their own mind, and through analysis based on Madhyamaka principles when concerning mind and the nature of physical phenomena. One of the central analysis processes is to propose that something has svabhāva—independent inherent nature. A good Madhyamika will then submit that statement to intense scrutiny, just as a good Socratic. One of the Madhyamaka premises is that for a physical phenomenon to be 'truly existent', it must have svabhāva, i.e. it will be independent, with inherent nature. Things without inherent nature—things that are śūnya—are in some sense unreal, since they lack independent identity. To be real, the phenomenon must *withstand analysis* based on the logic of Madhyamaka. There are several standard arguments used in such analysis, and we will critically analyze them in turn. We will find that the arguments use certain scientific premises about the nature of things, such as ancient atomic theory, or the idea that if we can break something into parts then it has parts before it is broken. We will find those premises fallacious.

One school of Buddhist theory of knowledge that many schools of thought adopt asserts that direct experience and inference are acceptable ingredients to knowledge. This is the epistemology of Dignaga and Dharmakīrti. It might be possible for us to extrapolate and conclude that Buddhists would hold in high esteem empirical research, the foundation of science. However, empirical research was not a focus of historical Buddhist knowledge acquisition, nor is it a favorite of

modern Buddhist scholars and meditation masters, notwithstanding the Dalai Lama's interests and some of his statements. While some have claimed that Buddhism is a science, this is not an easily justifiable view.

Lately, there has been increased interest in a 'contemplative science' of mind informed by Buddhist principles, cognitive science, neurophysiology and knowledge from many other disciplines. Some scientists have demonstrated changes in the brains of meditation masters indicating higher levels of peace or compassion. As acknowledged by the practitioners, this science—if it indeed is a coherent science—is in its infancy, and is not relevant to the current project. I will leave discussing it to the next series of books.

However, concerning the nature of physical science, I have found some statements that I consider inconsistent. We find the inconsistency in the writings of the same person, and as a community. Some contemporary Buddhist writers who write in the genre of Buddhism and science analyze physics with an anti-realist philosophical interpretation, saying that we should not have confidence in current physics because it has changed so often. In other writing these same writers, or other Buddhists, justify certain Buddhist principles—including śūnyatā—with the results of physics.

Actually, we should categorize some of those writings with the technical philosophy term as being pathological. By philosophical pathology, I indicate the tendency for some philosophers—East and West—to reject use of modern science as untrustworthy, yet use Grade 9 chemistry in their analysis. A completely consistent philosophy should use either no science or the best science. If we want any correspondence with the actual world, it seems impossible to use no science. Hence, we must trust our best science.

I provide an in-depth *Critical Analysis of Further Reading* in my *Volume 2* that analyzes many of those writings. In this volume, I simply justify a realist interpretation of physics and argue that physics does not justify Buddhist principles, yet show how we can have some confidence in both physics and those Buddhist principles without inconsistency, and even partly integrate them consistently.

D.2. Matter is mostly empty space, hence isn't really solid

First, matter is indeed mostly space. However, it is far from empty. Let us use a rock as an example. The rock has atoms, and multiply connected electromagnetic bonds hold them together. Picture a million-billion-billion atoms with EM fields as glowing electric fields filling all of the space connecting all the atoms together. We call this 'solid matter'. If we take this picture down to the region of each atom, we see even tighter bonds, brighter lights with frequent lightning bolts.

If we go further to the nucleus, we find even stronger force fields. The deeper we go the more material, physical energy fills the space.

Compare a rock with the atoms or molecules *unbound*. Simply free molecules of, e.g., a pile silicon dioxide not bound into quartz crystals, will act very differently than a rock. They may not be easy to generate, so let us think of finely ground rock dust as a close approximation. Imagine picking up a pile of fine rock dust and throwing it in the air. To compare, imagine picking up a rock and doing the same. Bonding matters. This demonstrates the material force of electromagnetic bonds. Loose atoms and empty space cannot break a window, while a rock certainly could.

Matter is solid and space is not an absolute void, anywhere in the universe. Space is actually full of material, physical energy everywhere, even in the 'void' of intergalactic space, let alone the solidly packed space in a rock.

D.3. Matter is only energy, hence isn't really real

This kind of energy is not spiritual, emotional, or mystical. This kind of energy is material and physical. Remember $e = mc^2$. Energy and mass are convertible. Energy has a mass, and mass has energy. There are four or perhaps five general kinds of energies. Each directly affect what we call matter. Matter, actually, such as elementary particles, are simply localized energy at high density, while space has non-localized generally lower densities—but there is a lot of space!

Energy is real and material. Matter is real and energetic. It seems to me that deep down, everyone really knows that matter is solid and real, or people would be shocked at how they could walk on the earth, and it would be much easier for tigers to eat us if we walked around caught up in our anti-realist philosophies. Tigers do not have such a problem. We might take such an approach only when we try to analyze rationally without basing our arguments on full knowledge of physics, or with use of the out of context extracts of oversimplified knowledge that we picked up from grade school or Cosmos documentaries. When we analyze fully, we find solidity without illusion. I will try to convince the reader of this as we proceed.

D.4. Buddhism is nihilist

Some Buddhists seem to be saying that nothing is real, but it comes down to how we define 'things' and 'reality'. My stance is that Buddhists do not teach that things are unreal in the sense that they do not exist *at all*. The key to understanding this is to realize that if we use a definition for 'real' or 'exist' that does not really characterize things, then nothing is real. Hence, if we define all things as being pink, polka-dotted, and 50 km high, then we must say that nothing is real. If we say

that things are real only if their nature is exactly how they appear, then we might have a serious discussion and decide that many things are not real simply because they seem different from the way they truly are. If we say that real things dependently arise, then independent things must not be real, and some (Abhidharma) Buddhists might say that nothing is real. If we say that things are only real if they have inherent nature, then some (Madhyamaka) Buddhists will say that nothing is real. These are technical definitions with enormous ramifications. Some (Chittamatra) Buddhists say that nothing is real except mind, but it all depends on how we define mind. If we use realistic definitions, i.e. definitions of the properties of things that actually correspond to the nature of things, then we find out that there are many real things. I do not think that Buddhism, in general, denies that. As they say, even a goat herder knows that.

D.5. Middle way emptiness is nihilist

In the English language, the word 'emptiness' has the implication of 'void nothingness'. Many Buddhist scholars and teachers, in writing and teaching, translate śūnyatā as emptiness, saying things are empty. The full meaning of śūnyatā is that things lack svabhāva, which we generally translate as inherent nature. Hence, śūnyatā indicates the lack of inherent nature, or being empty of inherent nature, yet many teachers and scholars leave out the rest of the phrase. Based on an object-oriented philosophy, we typically identify things by their inherent nature. Hence, it is easy to infer from śūnyatā to void nothingness. However, I will demonstrate that it is more consistent with the intent of the concept to resist that inference and implication, and realize instead that things exist with dependent or relational natures, and things are interactive and mutually interdependent. I will argue that this is a standard and reasonably common understanding of śūnyatā. I will resist using the word 'empty' for śūnya or 'emptiness' for śūnyatā, and thus make it easier to realize its true meaning.

D.6. The Unitary Principle: Destruction and composition

Here again is what I call the *Unitary Principle*: It is important to note that just because we can destroy something and obtain pieces does not entail that it is merely or ultimately those pieces, or that it's true nature is the true nature of its pieces. It does not even necessarily entail that it is composed of those pieces! It depends on what it is and what phenomenal domain one is investigating. The basic idea is that many types of things are atomically or sub-atomically bound in what is called a multiply connected lattice with quantum entanglement—and that includes protons, neutrons, atoms, molecules, lattice-crystalline solids (and most solids are such), crystal wineglasses and many other

common objects. In many domains, we must consider these as single entities, because they are single entities. The fact that they can be broken does not entail that they were composite prior to their destruction. It depends on context—or domain, as we call it. The unitary object had structural symmetries, and when these break, we are in a different domain with different entities.

D.7. The Las Vegas Principle

It turns out that there is an important dichotomy to the physical world between quantum domains and classical domains. Consistent with the pluralism that I promote in this book—justified by results in physics over the past 50 years—we should be aware of what I call the Las Vegas Principle: what happens in quantum domains stays in quantum domains. This principle is contrary to many analysts who take view that counterintuitive quantum properties are the ultimately true nature of all reality.

On the surface of things, it might be easy to deny the Las Vegas Principle. After all, all matter is made of atoms, and atoms are made of elementary particles. Atoms and elementary particles are quantum entities that exhibit counterintuitive phenomena like entanglement and wave-particle duality. Hence, we might argue that all matter also must exhibit those phenomena. However, physicists have performed many experiments that demonstrate the differences between quantum phenomena and classical phenomena. We will discuss some of those results and show how the Las Vegas Principle is appropriate for many phenomena.

D.8. Two Truths: Ultimate=global, relative=local

We will use the concept of the two truths from Buddhist philosophy—with a twist. The two truths express a standard view of many philosophical systems, East and West. There is the world of appearance, what we sense—or think that we are sensing—and what is real, what is underneath sense appearances that is an ultimate reality. Buddhists generally call the world of appearances the relative or conventional, and sometimes illusory and false. They call the true reality ‘ultimate’ or ‘absolute’. Other interpretations say that they are both true—after all, they are the ‘two truths’, not the one falsehood and the one truth. Nonetheless, even in the interpretation that allows the relative or conventional to be true, many consider it in some sense less true than the ultimate.

My problem with this concept is that ultimate is frequently determined through reductive fundamentalist perspectives, that what something is ultimately is what its parts are. This is somewhat the Abhidharma view, yet Madhyamaka cuts deeper, and finds no ultimate

reductive basis for building appearances. Thus, it again uses the reductive fundamentalist paradigm and concludes that since there are no fundamental structures, that the appearances are illusory.

This is a problem for modern understanding of the physical reality, as I understand it. Since some domains have pseudo-independence and we cannot justifiably break elementary particles into parts at all, then we must have a different approach. For this reason, I favor the terms local and global. Phenomena in particular domains demonstrate their local natures, and if we compare between domains we find a global nature. I will argue that there can be inherent nature in particular local domains—we will demonstrate that with physics analysis. However, when we compare between domains, we will find relationality in some domains that causally connects to the inherent nature that we found in other domains. How do we interpret the situation when we can track relationality as a cause of the inherent nature? That causality will not deny the inherent nature, simply because relationality causes it in some foundational sense. This is why we cannot use 'ultimate' since that minimizes alternatives. In my system, the global does not deny the local.

Note that it is not the case that we should identify local natures with the semantic dimension of relationality—merely conventions of word usage or concepts—and identify global natures as ontic, objective and real. Rather, we can identify all three dimensions of meaning, knowledge and being—semantic, epistemic and ontic relationality—in each of local and global characteristics of each of the three components of relationality (causal, mereological, temporal).

Therefore, I will interpret local truth as the truth that we find within a particular domain, and there may be different domains with different truths. Cross-domain analysis obtains a proxy for global truth, although that proxy *does not deny what is true and valid within particular domains.* This is the pluralist perspective embodied in my interpretation of the two truths: they are both true, each in its context.

There is a suggestion of that interpretation in classical presentations and discussion of śūnyatā, where we confine local conventional truth to the common sense or some other limited perspective, while we obtain global ultimate truth through extensive and intensive analysis. Hence, there is some correspondence between at least some classical Madhyamaka and my own interpretations. However, the major motivation for my interpretation of the two truths is due to analysis of contemporary physics and philosophy of physics, as supported by my examination of some contemporary arguments pertaining to some of the perennial Western metaphysical puzzles (see

Paul 2013). We explore the relevance and power of this pluralism throughout the book.

E. Outline and summary of the argument

E.1. General guidance

I suggest that the reader examine this introduction carefully, along with the outline of the chapters found in the following section. At that point, it may seem that the reader has alternatives. She may wish to dive in from the first chapter to the last. When reading each chapter, the reader may wish to proceed linearly from the beginning to the end, or go from the introduction to the summary-conclusions section. This latter alternative might be especially attractive if the body of the chapter seems to be tall with weeds of details, e.g. of the controversies around a particular topic, or if the topics are advanced. However, I have tried to introduce all controversies and advanced topics gently, for all readers.

I strongly suggest not skipping around the chapters. They are not entirely self-contained, and trying to read, e.g. about Buddhism first means that you will miss the context of science in which my comments about Buddhist philosophy reside, and all the many comments about Buddhism in that context that I make in the science chapters.

This book is not 'here is the way it is—believe me!' There is no gospel according to St. Robert. Rather, I acknowledge that every topic has many alternative philosophic perspectives, and I argue for what I think is correct while pointing to other views and references for the reader to decide for herself. I summarize the argument in the section below which outlines each chapter, and each chapter also has a summary review and forecast placing the argument of that chapter into its developmental position.

E.2. Outline and summary of the arguments

I have frequently found daunting the outlines and summaries of arguments within introductions to books. They typically assume that the reader already understands what the book is intended to show. They are typically too concise and miss so many details that they fail to provide incentive to read the book and rather discourage one from beginning. I hope that this outline and summary is different, if not concise.

- *Part A: Chapters 2-5:* Empirical reasoning: Science generally, informed by philosophy of science
- *Part B: Chapters 6-11:* Rational reasoning: Buddhism and Western metaphysics
    - *Chapters 6-7:* Introduction to Buddhism and Madhyamaka in general.

    - *Chapters 8-10:* Madhyamaka arguments of causality, composition and change.
    - *Chapter 11:* Western analytic metaphysics
- *Part C: Chapters 12-14:* Empirical reasoning: Physics
    - *Chapters 12-14*: The physics of causality, composition and change
- *Chapters 15+:* a summary of conclusions, references, etc.

Part A: Empirical reasoning, science and philosophy of science

'Empirical Science' is a redundant term, yet deserves the emphasis. The goal of this part of the book is to reach an understanding of the nature of science and physics theories, and confidence that in many domains and for many theories, we can believe in the truth of the statements of those theories. Science is therefore not discounted as a merely contingent, conventional or conceptual exercise. This is in contrast to the views of some philosophers who argue that rational analysis informed by commonsense provides ultimate truth. Commonsense is often wrong in physics—even physics graduate students sometimes give contradictory explanations of phenomena. Ultimate truth about the physical world requires good empirical evidence and theory. Armed with that confidence in the truth of some theories in some domains, and the criteria to decide which are true, in later chapters we use physics to analyze some Buddhist and Western philosophical arguments about the physical world.

The culmination of this *Part A* is more detailed introduction to the central features of physics that we will apply (hence then learn more about) throughout the book: structural symmetry and symmetry breaking, the *Unity Principle*, and the *Las Vegas Principle*.

Chapter 2: Introduction to science

In *Chapter 2,* we distinguish empirical activities from merely rational analysis, which is the distinguishing mark between science and non-science, respectively. We compare science with the mere categorization of phenomena, non-science, pseudo-science and religion. We explore the fundamental requirements of any empirical science, including observation, causal explanation, evidence and confirmation. We investigate different domains of different sciences, especially physics. Since contemporary conceptions of science define a theory as a set of models, we discuss the nature of models within a domain.

No one questions whether we can trust science to help with engineering to make bridges, rockets, and machines. The question is whether we can trust science to describe accurately the nature of physical reality in an ultimate sense. If we are to use science in determining the ultimate nature of physical reality then we need to

know what level of confidence is possible to obtain from science generally and in particular from its theories.

Physics has achieved great success, and this is undeniable. Yet history has eroded our confidence in our understanding of the nature of ultimate reality that physics theories describe. This erosion is due to the revolutionary paradigm shifts produced by discoveries in the early 20th Century, viz. relativity and quantum mechanics. We had confident arrogance in the past and where proved wrong, so how can we trust anything now? As with so many aspects of human awareness throughout that tumultuous century, it seemed that everything we held dear and true was proven illusive at least, if not totally false. Philosophers, physicists and mathematicians experienced mid-life crises of confidence. Just as with Buddha, Socrates and Descartes in their time, thinkers of recent times attempted to establish foundations of knowledge from which they could build viable formal frameworks, upon which we can work, understand our practice, and have confidence in our results.

Before we address the central question of trusting science, in this chapter we try to distinguish science as a conceptual framework. The basis of science is testing—no matter what we think is true, we must test our thoughts as hypotheses and acquire empirical evidence that may verify or falsify them. We must place the data within a framework of explanation, and generate further hypotheses and gather new data. Science is always being refined, but that doesn't mean that what we verified is necessarily false. Hence, we introduce the concepts of domains and models. Within certain domains, the hypotheses for which we have verification can remain true forever—only outside those domains, concerning phenomena for which we have no verified hypotheses will further truths be determined.

It is a central thesis this book that there are closed domains within which we have knowledge of what is true about the physical world. To demonstrate this thesis, we must approach further questions about the nature of physics and physics theories. Yet before we address that concern we discuss a thorn in the side of any discussion of science and Buddhism—the influence of mind. Both Western and Buddhist philosophy have seriously addressed the relationship between mind and our world throughout their histories. Science, and in particular quantum physics, has as well. One problem is that we have no comprehensive definition for mind. We discuss this question and conclude that physics has not (at least as yet) provided any verification that any mind directly influences the physical world without any intervening mechanical interaction, such as a hand or tool. Also, we frequently "know for certain" that something is true, yet then demonstrate how it is false.

This fact is—for me—good evidence that our biases and beliefs do not determine the nature of the world, just what we think about it. Yet, we know from social psychology and personal experience that our thoughts do influence what we perceive, up to a point.

Thus, in this chapter I develop what I call *The Primary Task*, which has two parts: First, figure out how our biases and conceptions change our perceptions and eliminate those biases and conceptions. Second, figure out what is left—that is the ultimate nature of the physical world independent of mind.

Chapter 3: Can we trust science? Realism and anti-realism

In regards the nature of science as a human enterprise, the issue of trust in science developed into a debate between realists and anti-realists, also called instrumentalists. Simplistically, realists hold that what verified theories say—and what the central terms of those theories refer to—actually exist in the world as described. When we say 'please pass the bread', we believe that there is bread to pass. The nature of verification and evidence becomes central to this view. Realists call verified theories 'approximately true' or 'partially true'. Non-realists say that this is simply not the case, arguing that even verified theories are merely calculation instruments that indicate nothing about the *ultimate metaphysical reality* underlying those calculations. The ultimate metaphysical reality is the objective and actual reality that is independent of theories, perspectives, human concepts and institutional funding agency agenda, if there is such a reality. Realists respond that it would be a miracle to have scientific success of calculations without correspondence between the theory's pronouncements and the actual nature. There are many arguments on each side to the debate and I will examine some of them. On the way, we will learn a bit more about the nature of science and theories. I argue it is justified to apply a realist interpretation to some theories in some domains. However, I also acknowledge that we must also apply an instrumentalist interpretation in different domains of our pluralist framework.

Chapter 4: What makes a physics theory: Physical Pluralism

In *Chapter 4,* we investigate some of the technical details about the pluralist framework that I develop—Physical Pluralism. Our goal in this short but dense chapter is determining the criteria for justifying the truth of the ultimate nature of metaphysical reality as described in certain physics theories. The major alternative to pluralism is fundamentalism, and we introduce some of the problems with that view. In this chapter, we weigh pros and cons, and partially justify a pluralist framework that can accommodate different interpretations and

perspectives. Further justification awaits the physics chapters in the last part of the book.

Physical Pluralism utilizes the concept of domains. Domains are the analog of contexts as used in philosophical or common discourse. A domain includes our understanding of the phenomena that we are discussing, including objects, processes, relations and any other interactions. The trajectory of a rock is in a different domain from the same rock subjected to acid or radiation. Each domain requires customized theories—for our example, they would be mechanics, chemistry or atomic theory, respectively. Domains of Physical Pluralism are not strictly closed, nor are the theories that describe the phenomena of each domain strictly independent of theories in other domains. I present the elements of physics theories and argue there are general principles that apply everywhere.

However, I also point out that those generally applicable conceptual structures do not simply determine what occurs, but rather merely place constraints on what can occur. For instance, we know that mass-energy is universally conserved, yet within the limits of that constraint many things could occur, depending on parameters within the domain. It is like free will: We cannot fight death, and other *stuff* happens beyond our control, but within those constraints, there are usually many available choices. Within constraints of general principles, physicists develop domain-dependent theories based on domain-specific experimental data.

We discuss the elements of a physics theory. The reader may wish to keep these in mind when we examine particular theories. We then discuss the credibility criteria that enable justification and confidence in the truth of a theory's statements about the nature of the physical world (realism). We compare this with the merely empirical adequacy of a theory that accounts for interactions and calculations without justifying knowledge about the nature of the physical world: antirealism or instrumentalism. Instrumentally, theories cannot describe ultimate causes of interactions. We might compare the latter with 'appearance' in Buddhist theories of knowledge, and many Buddhist views refuse to make statements about any reality beyond appearance. I, however, argue that it is possible to have confidence in many such statements. The question is 'merely' distinguishing which ones deserve such confidence.

Chapter 5: Introduction to the theories of physics

In *Chapter 5,* we discuss the basics of physics as the science of physical reality. We discussed the nature of physics theories in general and also the specifics of how to distinguish and categorize theories. Here we introduce general principles and developments in physics, and

many particular theories. These include Newtonian mechanics, more general classical non-relativistic physics theories like optics and thermodynamics, plus relativity and quantum physics.

We also introduce some particular principles of physics that we will use throughout the rest of the book. In particular we introduce the core concepts of structure, symmetry (hence structural symmetry), and symmetry breaking. Further, we introduce entanglement, which is a central phenomena of quantum mechanics and example of structural symmetry. We also elaborate on the *Unity Principle* and the *Las Vegas Principle* briefly summarized in the *Introduction* chapter. These principles are central to the critique of Buddhist arguments against independent entities that follow.

Part B: Rational reasoning: Buddhism and Western Metaphysics

In this group of chapters we discuss Buddhism generally and Madhyamaka in particular, plus some Western views that are relevant. However, our discussion is almost entirely in relation to the physical nature of physical reality rather than a personal journey of discovery of the nature of our own mind, which is the normal focus of Buddhist philosophy. We survey Buddhist philosophies and focus on Abhidharma and other schools of thought, which are the foundation upon which Madhyamaka stands. We then analyze both general and specific Madhyamaka arguments. I justify the approach of objectively, logically, philosophically and scientifically analyzing those arguments. We determine that those arguments are generally insufficient to obtain any certainty in the Madhyamaka view concerning physical reality. Yet, we do not simply throw out the principle of śūnyatā with the ancient, pre-scientific arguments that were used to support them in the past. Rather, we will find modern and justified perspectives that coincide sufficiently with our culture and worldviews about logic, philosophy and science in order for us to realize the plausibility of that principle. Armed with those insights we can proceed to transform our worldview.

Chapter 6: Buddhist philosophies of physical reality

Buddhism began with one man's quest to discover the causes of suffering and a path towards its alleviation. Out of that compassion and diligence arose realization of the nature of the world, i.e. how things ultimately are. That realization involved direct insights by the Buddha's non-conceptual mind, bypassing philosophies, analysis and theorizing. For a while after his realization, he did not think that he could communicate the truth to people, yet soon he began to teach and continued for 40 years. His mere presence inspired wisdom in others,

but when he or others spoke, they spoke with words and concepts, relating to people through their own culture and philosophies of the time. Each listener heard teachings that connected with their own viewpoints, thus there are many varieties of Buddhist philosophies. In an introductory manner, we discuss several of the main Buddhist schools of thought concerning the nature of the physical world.

In this chapter, we discuss the concepts that we use throughout the rest of the book: śūnyatā—lack of independence—and the three components causality, composition and persistence, which form the organizational structure of the three specific Madhyamaka chapters and the three physics chapters to follow. In this chapter, we further introduce the two truths, which are 'relative' and 'ultimate'. These concepts are difficult to understand in purely Buddhist terms, and mixing them with physics brings further complexity. However, it is through a particular revision of those concepts that I will indicate correspondence between Madhyamaka and physics perspectives.

Chapter 7: Madhyamaka of physical reality

In this chapter, we introduce the philosophy of Madhyamaka. Madhyamaka denies the existence of svabhāva, which we translate as inherent nature. Rather, it promotes the śūnyatā principle that nothing has inherent nature. Madhyamaka is coincident with *prajna paramita*, which is transcendental intellect, our cognitive function that intellectually understands and non-conceptually re-cognizes śūnyatā.

Śūnyatā is a lack of something, yet we may try to understand what this lack indicates about a world without any inherent nature, rather than settling for knowing what it is not. I argue that it is possible to conclude from the negative thesis—the objects, properties and processes that occur in physical reality lack inherent nature—to a positive thesis—that those aspects of reality are relational. Defining what inherent nature would be if it existed, and what relationality entails is, in some sense, the purpose of this book.

Madhyamaka is a set of philosophies about the nature, or lack of nature, of all phenomena. Direct, non-conceptual realization of the śūnyatā nature of our own mind and of our physical environment inspired those philosophies. Once we realize that there is no inherent nature, we can drop the conceptual confusion that clutters our perceptions. Then, there are no further barriers to the arising and perception of any phenomenal experience, regardless of previous value judgments. There are also no barriers to our performance of actions to help people. Such activities arise out of the compassion which is naturally existent within all of us, and which is uncovered through our perception of śūnyatā. These observations are the foundation, and then philosophies about the nature of physical reality without inherent nature

attempt to explain what Madhyamika meditation masters directly realized. My explanation results in an analysis of intrinsic properties and relationality in the context of our physical reality.

We continue to discuss more details of Madhyamaka and śūnyatā, including the general and specific argument types that Madhyamikas use in their analysis to 'establish' the lack of inherent nature in physical reality. I defend the position that many—if not all—of the reasonings in traditional Madhyamaka as used in India and Tibet that argue against the existence of inherent nature in physical reality are logically invalid and/or factually fallacious. This may seem like a harsh statement for Buddhist true believers. However, my position does not necessarily entail anything about the veracity of the basic śūnyatā principle. Rather, I argue that those ancient reasonings are *conceptual projections* of the principle of śūnyatā from non-conceptual realization into ancient languages, cultures, philosophies and pre-scientific intuitions regarding of physical reality. We will project it into our current intuitions and verified theories.

There are two basic issues in the arguments that we examine here: patterns of logical analysis and scientific knowledge of physics. By our standards, 'knowledge' of physical reality from 2,000 years ago was not very scientific, i.e. not empirical. It was rather more like metaphysical philosophy, and actually quite similar to some Western metaphysical philosophy that we examine later. Throughout this book, I analyze śūnyatā by applying standards of modern empirical physics and philosophic logic in argumentation. In this chapter I point out some of the problems with these argument types, and throughout the rest of the book provide both more details of the problems and indications of revisions that will stand up to such scrutiny.

In this chapter, we analyze the general Madhyamaka arguments for their philosophically logical structure and their correspondence with our knowledge of the physical world. The results of this chapter are central to understanding how we need to revise those arguments. We will begin to do so in the following three chapters.

Chapters 8-10, Madhyamaka: śūnyatā of physical reality

In the previous chapter, we discussed the general Madhyamaka argument types. In these three chapters, we discuss the specific types that correspond to each of the three components of svabhāva and śūnyatā. These components are, respectively, (1) causal independence and dependence in relation of one object to other entities; (2) independence and dependence in relation between a whole composite entity and its parts—if any; and (3) persistence and impermanence. In these three chapters, we examine the arguments regarding those components in more detail by examining Nāgārjuna's seminal text in

light of several commentaries, ancient and modern. We examine central arguments in detail to understand what Madhyamaka is promoting, and critically analyze them in light of modern philosophical standards and physics.

In these chapters, we point to the philosophically and physically sound arguments—in the context of Physical Pluralism—that correspond to the views of Madhyamaka. In the physics chapters we will develop those arguments further, and find their limitations. For example, we 'know' that atoms have intrinsic nature, violating śūnyatā. However, that intrinsic nature is confined to a domain, thus identified as 'relative' truth. 'Absolute' truth is identified as coming from inter-domain comparisons. Note, however, that the latter does not deny the former. Atoms indeed have intrinsic and inherent nature—in their domain, just as everything has a nature in a domain, but nothing has universal nature. This idea was introduced in the preceding section of this introduction chapter.

Chapter 8: Madhyamaka of Dependence: Causality without Production

In Chapter 8 we examine the main Madhyamaka argument from Nāgārjuna concerning cause and effect. Many agree that Nāgārjuna rejects a production theory of causality which posits something new coming from something old. Most interpret his view as defending a dependence theory of mutual interdependence. It is also common to interpret Nāgārjuna's view as a regularity interpretation of one thing following another, similar to Hume and without any necessity in the causal relationship. Hume famously said that all we know about causality is from our habits of connecting the generalities of some type of thing happening after some other type of thing happens: no necessity, no natural laws, no direct entailment from causes to effects, but rather simply coincidence. I argue that this is not either Hume's view or Nāgārjuna's, and also incidentally is counter to science generally and physics in particular. The latter supports a dependence theory of causality that is common in modern physics called *exchange of conserved quantities*. For example, (ignoring relativity and such messy details as friction for the moment, just to keep it simple) energy is conserved as two billiard balls collide, and energy is exchanged from one ball to another. This regular occurrence is fully necessary and we describe it with well-known theory and natural laws. While Abhidharma places cause and effect in entities, Madhyamaka and modern physics places causality in the interaction.

Chapter 9: Madhyamaka of Composition: Relations without Relata?

Both Abhidharma and Madhyamaka, and even some Western metaphysicians, deny the reality, i.e. the inherent nature, of composite entities. With the *sevenfold reasoning* Madhyamaka argues that if we try to identify inherent nature in the whole or parts of a composite entity, then logical paradoxes are produced. The only way out—Madhyamikas tell us—is to acknowledge no such nature in either parts or wholes. However, what can we say about the nature of 'ultimate' parts? Abhidharma promotes the idea that there are partless particles which are the 'elemental atoms' or building blocks of all matter. Madhyamaka utilizes the *neither one nor many* argument to deny that even those elementary particles could have inherent nature. However, physicists and philosophers of physics commonly point out that the elementary particles of modern particle physics have intrinsic properties, independent of anything else. Is this a denial of śūnyatā? In one sense it certainly is: there are independent entities that have intrinsic properties. These include crystalline rocks, molecules, atoms and other things that are 'normally' thought to be composite. Additionally, there are elementary particles that definitely have no parts. They are unitary in that they cannot be arbitrarily broken into pieces for analysis of their parts, since they have no. Hence, the Madhyamaka analysis cannot apply. Nonetheless, for some things, we may examine them in a cross-domain analysis and determine a causal relationship from 'smaller' entities to the 'larger' independent entities, and these may be interpreted—in other domains—as parts. Hence, we will have to revise both our understanding of śūnyatā and our understanding of physics in terms of pluralist, semi-independent domains to get a match, even though the match has limited applicability and utility. We introduced that correspondence in Chapter 9 during analysis of Nāgārjuna's arguments.

Chapter 10: Madhyamaka of Change: Impermanence and Momentariness

Abhidharma and Madhyamaka both argue that all things are impermanent. This seems obvious from our personal experience. They disagree only in how radically impermanent the things may be. Abhidharma supports the idea that things last for a moment; Madhyamaka argues that a moment would have a beginning, middle and end, and each of those three would have those three again, never-ending in infinite regress—thus there are no moments either. Madhyamikas never considered the idea of continuous time with zero-durations that can nonetheless sum to become finite durations, which is

not a surprise before the Western invention of calculus. The present moment has zero duration, yet there is no 'next' or 'previous' moment—it is a continuous flow of time. However, the Madhyamaka proposal of continuous impermanence that I call *radical impermanence* concerns objects, not time. Can we support the idea that things do not persist? We see things simply persisting for significant durations, and can imagine that they could persist for very long times. I argue that neither Buddhist school can justify the universal view of impermanence of all things with consistent reasoning, although my argument will not become completely clear until we analyze the physics in a successive chapter.

Chapter 11: Western Analytic Metaphysics

In terms of physical reality, the traditional Buddhist arguments did not use empirical results of modern physics, and most contemporary authors do not even offer modern modifications to those arguments (see my *Critical Guide to Further Reading* Appendix in Volume 2). Because of this situation, the arguments are not meaningful, and further do not provide accurate conclusions. Perhaps contemporary Western philosophic analysis in the metaphysical tradition provides insights for our issues. We therefore briefly examine several modern arguments concerning causality, mereology and change. We find arguments that are similar to Abhidharma, and as equally fallacious.

Part C: Physics: Chapters 12-14

In these three chapters, we ask whether it is necessarily true (according to our best physics theories) that we can accurately categorize all physical phenomena as śūnya, i.e. lacking inherent nature. In order to answer we use different theories examined in relation to each of the three components of independence and dependence.

Chapter 12: Physics of Dependence: Conserved Quantities

Here we explain the *conserved quantities* theory of causality in more detail. We look at causality in several classical and quantum physics theories to see whether the interdependence principle of śūnyatā makes sense (judged by these theories in their domains) and if the idea is useful to inspire further developments. We will look at the flashy modern theories that are part of the clusters of theories denoted by the terms relativity and quantum physics, but also look at the more mundane classical physics theories, including classical mechanics, thermodynamics, optics, classical electrodynamics, and chemistry, plus the amalgam that is condensed matter (solids) physics. The conserved quantities view—which is a stable and standard view of physics—

seems to correspond strongly to the interdependence interpretation of Nāgārjuna that I proposed in Chapter 8.

Chapter 13: Physics of composition: Classical-Quantum, Particles-Fields

Madhyamaka posits interdependence between parts and wholes and the lack of any inherent nature in either composite wholes or fundamental particles. This may entail that there are no fundamental particles, or it may entail other hypothetical conjectures concerning matter. I previously argued that the Madhyamaka reasonings concerning parts and wholes are either metaphysical wordplay—semantic puzzles that have no correspondence to physical reality—or are factually fallacious according to facts that we now know. To arrive at valid and true statements, we must apply a modern standard of philosophical logic and a modern physics view of the nature of matter and energy. We will discuss and apply common chemistry and the foundational issue of quantum entanglement and denial of local realism in order to determine what physics has to say about the relationship between parts and wholes. Herein will be the justification and many examples of the *Unitary Principle* and the *Las Vegas Principle.* Many entities are clearly composites, but I argue that many others are independent unitary entities that have no parts. They can be broken into parts, but the breaking destroys what they were. Similarly, just because the quantum domain is fraught with chaotic motion does not entail that at least some classical domains are not securely stable. I argue for a pluralist understanding about these relationship, and find some correspondence with śūnyatā—but only in that pluralist interpretation and not universally.

Chapter 14: Physics of Change: Relativity & Quantum Gravity

Madhyamaka reasonings argue that everything is impermanent, but physics may have something else to say about that. Sure, according to the latest cosmology, there was a big bang that started all of existence, and there may be a big crunch to end it. However, there may not be such a contraction.[1] Our sun will expire someday, but this is not fundamentally the kind of impermanence that śūnyatā identifies. Madhyamaka posits a radical impermanence whereby everything changes continuously. We will examine change and time and then see what physics theories have to say about that. Every proton, for instance, has a lifetime (if left to its own devices) longer than the current age of the universe. How can Madhyamaka accommodate that? Saying that it is ultimately made of dynamic quarks resorts to the reductive approach,

[1] The 2011 Nobel Prize for Physics was awarded for discovery of the acceleration of our universe, which may result in an infinite expansion and ultimate cooling.

but a proton is a unitary entangled system also, as discussed in Chapter 14. We must apply a pluralist framework to make sense of this.