Framework for Unification of Physics

Philip Carter

First Published: April 7, 2010
Version 2: October 15, 2010

PO Box 206
New Denver BC
Canada V0G 1S0
quanta (at) esotec.org
http://physics.esotec.org

Abstract

On the basis of acknowledged quantum facts it is argued that the quantum state is extended in four spatial dimensions in a 4D space interpenetrating our 3D space. The notion of branes is borrowed from M/String Theory to conceptualize the spatial arrangement. Euclidean spacetime is reinterpreted as the spatial geometry of the 4-brane, with "imaginary time" reinterpreted as the fourth (imaginary) spatial dimension. The imaginary axis of the quantum state is identified as its fourth spatial dimension, yielding a natural union of Special Relativity and Quantum Mechanics and the emergence of time. Spatial properties are shown to explain quantum nonlocality, while time in the 3-brane emerges from motion of or through the imaginary dimension in the 4-brane. A consciousness-model is introduced which conforms to the spatial configuration while providing mechanisms for resolution of the Measurement Problem.

Keywords: quantum mechanics, relativity, unification, braneworlds, Minkowski space, nonlocality, imaginary time, imaginary space, extra dimensions, consciousness, esoteric science.

Contents

Illustrations

1. Introduction

Historically, progress has been made in science when Nature has been heeded, no matter what the intellectual or philosophical consequences. When Max Planck reluctantly allowed energy to come in discrete units, Quantum Mechanics was born. When Albert Einstein listened to what Nature was telling him, that the speed of light is constant in all reference frames, he arrived directly and unambiguously at Special Relativity. Again, when he heeded Nature's advice that inertial mass and gravitational mass are indistinguishable, he was directed to his masterwork, the General Theory of Relativity.

Physics today is facing a number of enduring paradoxes, suggesting that we are not heeding Nature. For eight decades the foundational underpinnings of Quantum Mechanics have defied all attempts at consistent explanation, while Quantum Mechanics and Relativity have remained aloof and fundamentally incompatible. Essentially three central problems are addressed in this paper: the foundations of Quantum Mechanics; the reconciliation of Quantum Mechanics and Relativity Theory; and the intrusion of consciousness into quantum phenomena, generally known as the Measurement Problem.

Our approach to tackling these problems is as follows: We look directly at the evidence and accept it as fact; then we throw out all preconceptions and attempt to deduce a consistent explanation of the facts, regardless of the consequences. My hope is that this will prove a more productive approach than trying to patch up the old paradigms, which appear to be shining little light on the big problems of physics.

The first half of the paper rests on physical principles alone, culminating in a clear prescription for the reformulation of Quantum Mechanics, yielding a natural union with Special Relativity along with fresh insights into time and quantum phenomena. Having achieved this, we approach the somewhat more abstract problem of consciousness, without which no physical framework can be complete.

To address the problem of consciousness we introduce a consciousness-model from outside of physics which conforms to the spatial configuration previously determined by physical arguments alone. To justify this intrusion of philosophy into physics the author is obliged to provide a philosophical context. Accordingly, the second half of the paper addresses both physics and philosophy, and in particular the philosophical consequences of the current framework, which are no less than revolutionary.

The author makes no claim of final rigor along these lines of thought, but seeks to uncover a consistent framework capable of solving the big problems. While the details of the framework remain speculative, the central conclusions emerge logically from accepted theoretical and experimental facts and hence are difficult to dispute. The line of reasoning presented here is predominantly conceptual (non-mathematical), with the exception of the Minkowski metric and imaginary numbers. The argument is founded on elementary physical principles, in part to render it accessible to a general readership, but also to provide the opportunity for reinterpretation of standard physical concepts. Please note that the terms *wavefunction* and *quantum state* are used somewhat arbitrarily to refer to the quantum entity whose evolution in time is described by the Schrödinger equation.

Part 1: Physics

2. The Evidence

We begin with the following facts about our universe:

1. Our physical universe appears to have three spatial dimensions. Beyond our subjective convictions, this is confirmed by the inverse-square law of gravitation.
2. Special Relativity provides a consistent description of our (3 + 1) spacetime (our three spatial dimensions plus one time dimension) for inertial (non-accelerating) reference frames. This description has never been experimentally violated at a classical (non-quantum-mechanical) level.
3. Bell's Theorem and subsequent experiments (in particular that of Alain Aspect, 1982) have established beyond reasonable doubt that the quantum state exhibits nonlocal (superluminal) behavior [1]. Nonlocality, entanglement, and the holistic nature of the quantum state are to be taken as facts of Nature. These facts appear to violate the laws of Special Relativity.

3. The Essential Consequence

Quantum nonlocality cannot be explained within the laws of Special Relativity, which are the laws governing our spacetime for inertial reference frames. If both Relativity and nonlocality are correct descriptions of Nature, then the evidence requires the quantum state to be outside the jurisdiction of Special Relativity, meaning outside of our (3 + 1) spacetime.

David Bohm, the maverick and insightful quantum theorist who was never afraid to break convention and think outside the box, expressed this conclusion as follows:

> **One discovers, both from consideration of the meaning of the mathematical equations and from the results of the actual experiments, that the various particles have to be taken literally as projections of a higher-dimensional reality which cannot be accounted for in terms of any force or interaction between them.** [2]

To illustrate, one may consider a quantum wavefunction that exists simultaneously in two locations in three-dimensional space (sometimes interpreted as a particle being in two places at once). While quantum theory asserts that the two are in fact one and the same wavefunction, in three-dimensional space they are clearly separated, and according to Special Relativity no signal can pass between them at greater than light speed. If we are forced to accept that the two "parts" of the wavefunction are in fact aspects of one and the same wavefunction, and if they are not connected in 3D space, then we must conclude that the quantum state is extended in (at least) one other spatial dimension beyond our familiar three. A direct reading of the facts makes it logically difficult to avoid this conclusion. Hence, heeding Nature, we will elevate this conclusion to an inferred principle and see where it leads.

- The quantum state is extended in four spatial dimensions (economy precludes more).

Having embraced this essential consequence, we can deduce the following:

- Since the quantum state is extended in four dimensions, then clearly it must exist in a 4D space.
- Since the quantum state is directly associated with objective physical phenomena in our 3D space, this 4D space must be superimposed upon (interpenetrates) our 3D space – that is, the first three dimensions of the two spaces correspond.
- To be consistent with observed quantum phenomena, this 4D space – or (4 + 1) spacetime – must have nonlocal properties. That is, it must be *spacelike*, in contrast with our (3 + 1) spacetime which is local, or *timelike*. (These terms are explained in Section 7.)

4. Brane Models

The notion of *branes,* as conceived by M/String Theory, can be applied here to good effect. A *brane* (from *membrane*) is a space of particular dimensionality dwelling within a higher-dimensional space (called the *bulk*). According to convention, a 3-brane has three spatial dimensions, a 4-brane four spatial dimensions, and so on. We can imagine our physical space as a 3-brane occupying the same higher-dimensional space as a 4-brane, which is home to the quantum state.

Brane models require that all matter and forces be confined to a brane, with the exception of gravity which is free to travel in the higher dimensions. Meanwhile, the inverse-square law of gravitation demands that the higher dimensions don't leak gravitation from our (3 + 1) spacetime. Various theoretical approaches have been taken to confining gravity within spaces with extra extended or compactified dimensions. [3]

In this paper I form no hypothesis regarding the theoretical structure of these spaces. Rather, the intent here is to deduce the *properties* of these spaces required to explain the observed facts and unify physics. Whether or not these spaces resemble branes, as conceived by M/String Theory, for the purposes of this paper I will borrow the term to represent materially isolated yet interpenetrating spaces of varying dimensionality. Applying this terminology, we establish the following:

- The quantum state, being extended in four spatial dimensions, is constrained to occupy a 4-brane which is interpenetrating our 3-brane.

5. The Mystery of i

For the sake of non-mathematical readers we take a brief diversion into the mysterious world of imaginary and complex numbers. An *imaginary* number is some real multiple of i, denoting the *square root of minus one.* Clearly, there is no physical number that when multiplied by itself yields minus one, since both positive and negative numbers square to positive numbers. Hence, i is considered "non-physical", whatever that is supposed to mean. A *complex* number contains both a real part (a real decimal number, for instance) and an imaginary part, which is some real multiple of i.

While real numbers are somehow related to the notion of quantity, we cannot form such an image of i. When two imaginary numbers are multiplied together one gets a real number, however, and that's all that matters for imaginary numbers to be useful in the real world. For several centuries, scientists, mathematicians and technologists have successfully applied the magic of complex numbers to real physical problems with no clear picture of what imaginary numbers actually *represent* – if not a physical quantity, then what?

It should come as no surprise, then, that these mysterious imaginary numbers lie at the very heart of the quantum world, in the descriptions of the amplitudes of the quantum wavefunction. What are we to make of this? We shall see that by making sense of the quantum world, we begin to make sense of i itself. [4]

6. The 4D Wavefunction

Quantum Mechanics is currently formulated in three spatial dimensions. The first task is to determine how it can accommodate four. It turns out that it already does – partially. And here we gather insight into a number of mysteries.

A wavefunction can be visualized in its momentum representation, at one moment of time, as illustrated in Figure 1, adapted from illustrations by the eminent mathematical physicist Roger Penrose [5]. The wavefunction is extended in some direction in 3D space, shown as the *x*-axis, while the amplitude is defined on the complex plane normal (at right angles) to the *x*-axis. This complex plane is conventionally not considered part of "actual" space, but as inhabiting some abstract mathematical realm, as Penrose explains:

> **The *x* direction in my picture corresponds to some actual direction in ordinary space, but the *u* and *v* directions are not ordinary spatial directions; they are put in to represent the complex plane of possible values of the wavefunction... To get the *full* picture of these waves, we should have to try to imagine that this is going on in all the three dimensions of space at once, which is hard to do, because we would need two extra dimensions (five in all) in order to fit in the complex plane as well as the spatial dimensions!** [6]

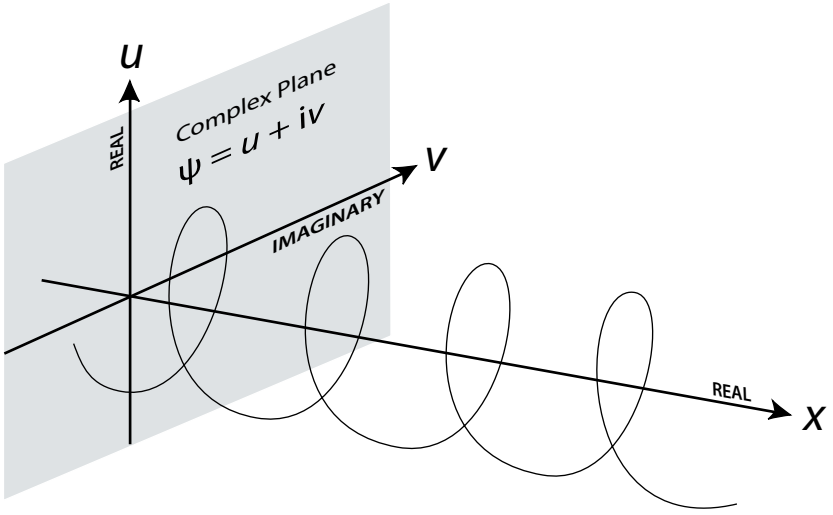

Figure 1: Momentum representation of a wavefunction at one moment of time.
The amplitude of the wavefunction ψ is given by the complex number *u* + i*v*. (After Penrose, 2004.)

From these descriptions it would appear that the wavefunction is considered to have "real" spatial extension but no objective amplitude. It is difficult to imagine how such a schizophrenic entity could lie at the heart of physical Nature. I wish to propose an alternate interpretation, as follows.

The complex plane is indeed part of "actual" space. The real part (*u* in Figure 1) corresponds to a real direction in 3D space, normal to the *x* axis, where the wavefunction has real amplitude. The imaginary axis (*v* in Figure 1) corresponds to the *fourth spatial dimension*, where the wavefunction has imaginary amplitude – being a factor of i. All other phases (angles of rotation on the complex plane) have amplitudes defined by complex numbers, being a mixture or real and imaginary amplitudes. Hence:

- The imaginary axis of the quantum state constitutes its fourth spatial dimension.

It follows that quantum theory already codifies the fourth spatial dimension, but not completely. The wavefunction's *amplitude* in imaginary space is precisely defined, but the author is aware of no mechanism in current quantum theory for *translation* (motion or linear displacements) on the imaginary axis.

What exactly *is* translation of the wavefunction in this "imaginary" fourth spatial dimension? What are the physical consequences? To answer this question we need look no further than another theoretical structure where imaginary numbers appear, that being the heart of Special Relativity, *Minkowski space*. And here we encounter the deep connection between Relativity and Quantum Mechanics.

7. Minkowski Spacetime

In 1908, three years after Einstein published his Special Relativity theory, his former mathematics teacher Hermann Minkowski codified the theory in an elegant mathematical scheme called *Minkowski spacetime*. This mathematical space is not generally considered to represent "actual" space, since it includes the dimension of time, which mathematically is treated differently from the spatial dimensions. Each point in Minkowski spacetime represents an *event* at a particular location in both space and time.

Minkowski spacetime is represented graphically in Figure 2, with the horizontal axis representing all three spatial dimensions and the vertical axis representing time. We have reduced the four-dimensional Minkowski spacetime to the two-dimensional graphic by placing all three spatial dimensions on the horizontal axis. The diagonal lines represent the paths of photons moving at the speed of light, which in

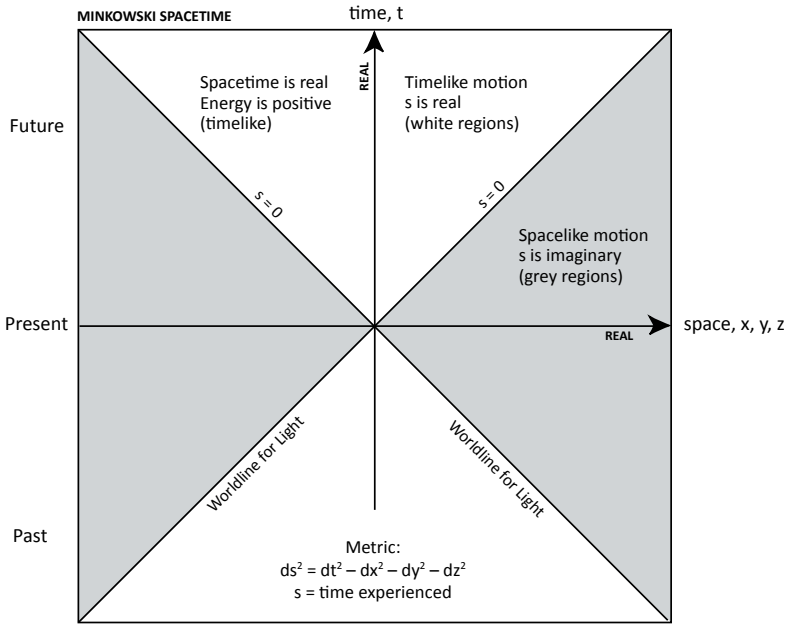

Figure 2: Minkowski spacetime. Units are chosen so the speed of light *c* = 1.

three dimensions form what are called *light cones* or *null cones*. The cones converge at the present moment; if you are located at that point in spacetime, the past cone defines the totality of spacetime where events could have influenced your present moment, while the future cone defines the full extent of spacetime that you can possibly influence in the future.

Minkowski spacetime unites our three spatial dimensions and one time dimension by way of the *Minkowski metric*, being the rule defining "displacement" in Minkowski spacetime. The metric is defined in alternate ways, the most "physical" formulation being as follows (measuring from the origin):

$$s^2 = t^2 - x^2 - y^2 - z^2$$

This expression is clearly related to the Pythagorean theorem in four dimensions; just the signs are different. Units are chosen so that the speed of light c is set to 1 (*seconds* and *light-seconds*, for instance), with t being time, x, y and z being the spatial dimensions, and s being the *time experienced* (or measured by an ideal clock) when traversing a worldline (path through spacetime) of displacement s. Remarkably, all of Special Relativity drops out of this simple expression.

Values of s are real (s^2 is positive) only within the past and future light cones, these regions being known as *timelike*. An alternative formulation of the Minkowski metric gives positive (real) displacements for *spacelike* regions, being those outside the light cones, denoted as l and expressed as follows:

$$l^2 = -t^2 + x^2 + y^2 + z^2$$

This expression shows an even closer resemblance to the Pythagorean theorem in four dimensions (more technically known as the distance metric in Euclidean 4-space, or E^4). This resemblance provoked early Relativity theorists to complete the analogy by employing a mathematical "trick", as Roger Penrose explains:

> **In the early days of relativity theory, there was a tendency to emphasize the closeness of [Minkowski] geometry to that of [Euclidean] geometry by simply taking the time coordinate t to be purely imaginary: $t = iw$. [7]**

The alternate formulation of the Minkowski metric then becomes:

$$l^2 = w^2 + x^2 + y^2 + z^2$$

This procedure later led to the idea of *Euclideanization* of spacetime. According to this scheme, the time coordinate is "rotated" on the complex plane into $\tau = it$, where τ is known as "imaginary time" [8]. This scheme has been particularly successful in providing consistent solutions within the context of Richard Feynman's "sum over histories" approach to quantum theory, as Stephen Hawking explains:

> **To avoid the technical difficulties with Feynman's sum over histories, one must use imaginary time. That is to say, for the purposes of the calculation one must measure time using imaginary numbers, rather than real ones. This has an interesting effect on space-time: the distinction between time and space disappears completely. A space-time in which events have imaginary values of the time coordinate is said to be Euclidean, after the ancient Greek Euclid, who founded the study of the geometry of two-dimensional surfaces. What we now call Euclidean space-time is very similar except that it has four dimensions instead of two. In Euclidian space-time there is no difference between the time direction and directions in space… As far as everyday quantum mechanics is concerned, we may regard our use of imaginary time and Euclidean space-time as merely a mathematical device (or trick) to calculate answers about real space-time. [9]**

In 1983 Hawking and James Hartle applied the concept of imaginary time to a cosmological model known as the "no boundary" proposal [10]. Roger Penrose weighs in on this procedure as follows:

> **I shall come to my reasons for being considerably less than happy with this type of procedure (at least if it is regarded as a key ingredient in an approach to a new fundamental physical theory, as it sometimes is; the device is also used as a "trick" for obtaining solutions to questions in quantum field theory, and for this it can indeed play an honest and valuable role). [11]**

The "fundamental physical theory" referred to by Penrose (at least in part) is the Hartle-Hawking proposal.

Perhaps his concerns will be put to rest and the "no boundary" proposal will receive renewed attention as a consequence of the current framework (reinterpreted as the global geometry of the 4-brane). What is important here, however, is that both theorists agree that the "mathematical trick" of imaginary time is effective and legitimate in obtaining certain solutions in quantum theory. What is Nature trying to tell us? By resolving this question we fit the next piece into the framework for Unification.

8. Minkowski 4-Space

In the identity applied by the early theorists, $t = iw$, the time coordinate t is assumed to be imaginary. (Refer to Penrose, quoted on the previous page.) Mathematically, however, time may be real and w imaginary, and we can write, $w = it$ (or $t = w/i$), which corresponds to the formulation of imaginary time, reinterpreted as the fourth spatial dimension. My proposal is as follows:

- There is no such thing as *imaginary time* (in the 3-brane), but there is *imaginary space* (in the 4-brane).

Figure 3 illustrates what I call *Minkowski 4-space*. Perhaps the early Relativity theorists were closer to reality than they could have realized. Minkowski 4-space is essentially Euclidean spacetime, except the "imaginary time" dimension is reinterpreted as the fourth spatial dimension, w, which is imaginary. My contention is this:

- Minkowski 4-space describes the (local) geometry of space in the 4-brane. The quantum wavefunction lives and moves in Minkowski 4-space.

Notice that this union is possible only because the wavefunction is (or can be) defined in three real spatial dimensions plus one imaginary spatial dimension, corresponding to the geometry of Minkowski 4-space (which, unconventionally, I call a *complex* space). One can visualize this marriage schematically by substituting Figure 3 for the complex plane in Figure 1 (page 6), with the imaginary axes aligned.

Consequently, Feynman's sum over histories approach works consistently in "imaginary time" because the wavefunction is moving in the four spatial dimensions of the 4-brane, one of which is imaginary. The required mathematical "trick" is a straightforward consequence of Nature. I will stop short of calling this mathematical "proof" that the wavefunction lives in a 4-brane, but it is certainly incisive evidence.

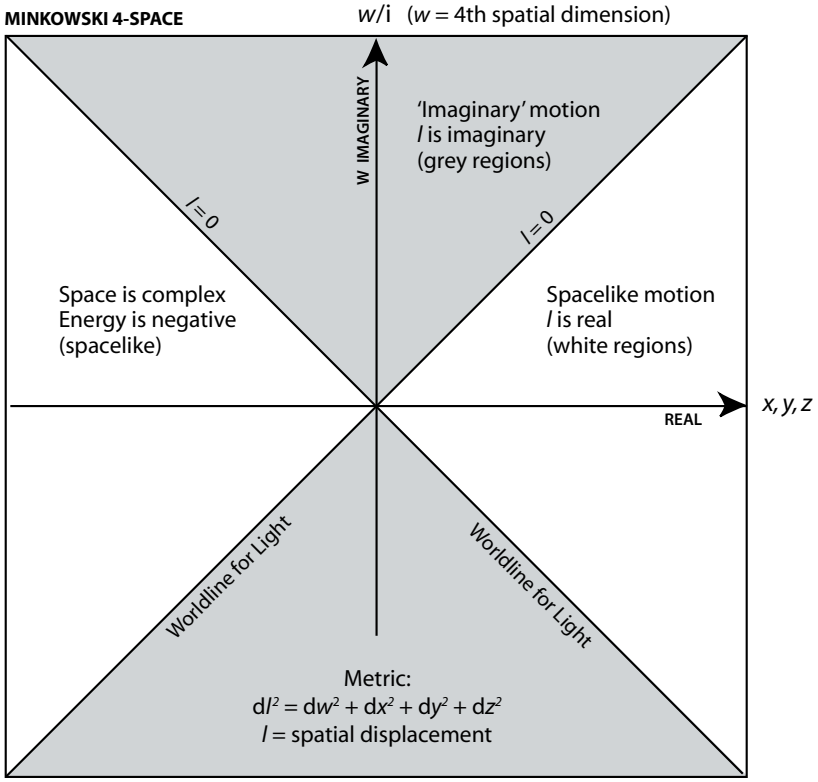

Figure 3: Minkowski 4-space

Nature does not play tricks with Her mathematics, of course. If we need tricks, there is something we don't understand. I should point out that this applies to quantum field theory generally, which requires many such "tricks" to avoid nonsensical solutions. [12]

Notice, I say that Minkowski 4-space is a description of *space* in the 4-brane, not spacetime. We will address the notion of time in the 4-brane later. First we need to ask: What exactly is "imaginary" space?

9. Imaginary Dimensions and Complex Space

What does it mean to say that the fourth spatial dimension is *imaginary*? What sort of "space" would be measured by imaginary numbers? Here we gather some insights into the mystery of i. A clue is found in the Minkowski metric itself, since the imaginary dimension *reduces* distances in Minkowski 4-space (since all four dimensions are spatial, this displacement must really be understood as a distance!). Hence, the imaginary dimension is in some sense *inside* or *enfolded within* the three real dimensions (topologists please come forward). Further, the imaginary fourth dimension renders the entire 4-space a *complex* space. While a complex space is conventionally a space having complex dimensions (such as the abstract *Hilbert space* underlying modern formulations of Quantum Mechanics), here the term refers to a space having *both real and imaginary dimensions*. Further, I am suggesting that spatial dimensions in Nature are either real or imaginary, never a combination of the two (complex). Accordingly, a key proposal is as follows:

- A complex space (having both real and imaginary dimensions) manifests *negative energy states*. Hence, because Minkowski 4-space is a complex space it embodies negative frequencies and energies.

According to Relativity theory, the motion of positive energy states in Minkowski spacetime is confined to the past and future light cones – what is called *timelike* motion, which cannot exceed the speed of light. Negative energy states, on the other hand, are confined to the *spacelike* regions outside the light cones, where only superluminal speeds are allowed – including infinite speeds (action at a distance, or nonlocality). Notice that displacements in the "timelike" (imaginary) regions of Minkowski 4-space are imaginary, while displacements in the spacelike regions are real.

The spacelike properties of negative energy states in Minkowski 4-space provide a clear basis for explaining nonlocal quantum phenomena. Note that these are properties of space itself, since Minkowski 4-space has no time dimension. It is expected that these *spatial* properties will endure when a time dimension is added to the 4-space, in which case the essential relativistic mechanism for nonlocality in the 4-brane is in place. We will come back to this after we consider the emergence of time in *our* world.

10. The Emergence of Time

It is proposed that physical time emerges when Minkowski 4-space (the 4-brane) is projected (squeezed) into our 3-brane. The fourth spatial dimension cannot be directly reflected in our three dimensions, so we are shown a slice of it each "moment of time". Hence:

- The arrow of physical time corresponds to motion in or of the (imaginary) fourth spatial dimension.

The evolution of the wavefunction is by some mechanism synchronized to the passage of the fourth spatial dimension. Figure 1 (page 6) shows the conventional understanding of the wavefunction in physical space, with its amplitude defined on the complex plane, at one moment of time. As the wavefunction evolves in time it evolves on *all* axes, including the imaginary axis (the fourth spatial dimension). Or perhaps a more accurate description is as follows:

- The fourth (imaginary) dimension flows through the wavefunction (all wavefunctions), *driving* the evolution of the wavefunction and thereby *creating* time in our 3-brane.

The wavefunction transforms imaginary motion (in the 4-brane) into real time (in the 3-brane). This motion or translation of the imaginary dimension through the wavefunction is not codified in current quantum theory. If this mechanism does exist in Nature, however, it is expected that time will become an operator in Quantum Mechanics rather than a parameter.

The notion of *translation* or *motion* of the imaginary fourth dimension should be approached with care. How can we understand "imaginary" motion? Further, in the context of a cosmological model such as the Hartle-Hawking no boundary proposal, this "motion" might be better considered as a *rotation*. A key point is that this motion is *asymmetric*, being the source of the arrow of time.

Upon closer investigation it is seen that the wavefunction oscillates between "past" and "future" as its phase revolves through the imaginary and real dimensions. This is a profound result, potentially explaining many diverse phenomena while raising many questions. More will be said about this in Section 20.

11. Time in the 4-Brane

We observe that while the *nature* of the wavefunction is spacelike (nonlocal), the *evolution* of the wavefunction is timelike. The 4-brane is home to the wavefunction, and the wavefunction cannot evolve in a world without time. Hence, for the current framework to be consistent, we require "time" in the 4-brane, creating a (4 + 1) spacetime where both spacelike and timelike displacements are allowed.

By analogy, just as physical time emerges when the 4-brane is projected into our 3-brane, we propose that time in the 4-brane emerges from a 5-brane being projected into it. That is, time in the 4-brane corresponds to translation (motion) of a fifth spatial dimension.

It is proposed that the fifth spatial dimension is imaginary, like the fourth, and that the imaginary fourth and fifth dimensions bind together in the 5-brane (mathematically as a product) to form a compound *real* dimension. Consequently, the 5-brane space is real but retains imaginary layers within it. Being real, like our 3-brane, the 5-brane is a positive-energy world.

The interface between the 5-brane and the 4-brane is analogous to that described by quantum theory, which relates specifically to the interface between the 4-brane and our 3-brane, except the polarities are reversed. Since the 5-brane is a positive-energy world, the 5D "wavefunctions" in the 5-brane are positive-energy entities in relation to the negative-energy 4-brane, whereas our 4D wavefunctions are negative-energy entities in relation to our positive-energy physical universe. Consequently we can expect "time" in the 4-brane to have very different properties from time in the 3-brane.

Since negative energy states can traverse the first three dimensions nonlocally in the 4-brane without displacement in "time" (the imaginary fourth dimension) at all, it is reasonable to expect that this property of Minkowski 4-space will remain in a (4 + 1) spacetime. But can negative energy states undergo local, timelike displacements in the 4-brane? At first glance the reader might assume this would not be possible, just as spacelike (superluminal) motion is not possible for positive energy states in the 3-brane.

We should not be too hasty in jumping to such conclusions, however, without a better understanding of the properties of (4 + 1) spacetime. If time in the 4-brane emerges from translation of the fifth dimension (which is imaginary), then we would expect time in the 4-brane to be real, as in our 3-brane. Hence, in the 4-brane we have real time in a complex space, in contrast to our (3 + 1) spacetime where both time and space are real. Accordingly, we can make the following prediction:

- Nonlocal (spacelike) displacements of negative energy states occur in the 4-brane according to the properties of Minkowski 4-space alone, while local (timelike) displacements arise from the properties of (4 + 1) spacetime, consisting of real time in a complex space.

It is also conceivable that 4-brane time emerges from the combined (or synchronized) motion of the fourth and fifth dimensions, which together are real, in which case time in the 4-brane would be imaginary. It is clear that in this case the properties of (4 + 1) spacetime would be very different. This scenario is considered unlikely, however, for philosophical reasons that I won't enter into here.

One can visualize (4 + 1) spacetime by imagining the "time" axis passing through the origin of Figure 3 (page 9), normal to the page, keeping in mind that the horizontal axis represents all three physical spatial dimensions, and the vertical axis the fourth (imaginary) spatial dimension. I will not speculate further on this subject, except to say that (4 + 1) spacetime is clearly a far more complex reality (no pun intended) than our (3 + 1) spacetime, calling out for detailed mathematical investigation.

12. The Cosmic Metronome

The physical universe evolves through time with the order and harmony of a vast clockwork, with atoms, planets, stars and galaxies circling and whirling in perfect synchrony. No matter how far we look, a great cosmic heartbeat appears to spread throughout the universe, keeping all things "in sync" under the guiding laws of Relativity, which are the dynamical laws of space and time. We call this *objective* time, according to which the objective universe evolves. Objective time should have an objective source: What is this source that synchronizes the physical universe? Or, according to the current framework, what determines how "fast" the wavefunction experiences the passage of the imaginary (fourth) dimension?

The cosmic clock must beat in the 4-brane in order to drive the wavefunction's evolution in time, and hence our 3-brane's evolution in time. It appears that *locally* we are moving through the imaginary dimension at a constant rate everywhere, with global spacetime (relative space and time) adhering to the laws of Special and General Relativity. One would presume that this motion is related to time in the 4-brane, which in turn emerges from motion of the fifth dimension in the 5-brane. So we have just pushed the problem back. What ultimately determines these spatial motions, and hence the origin of time? We are entering the realm of philosophy and I offer no answer here.

13. Prescription for Unification (Summary)

- Recognize that the quantum state is extended in four spatial dimensions and hence that it occupies a four-dimensional space (conceived as a 4-brane interpenetrating our 3-brane).
- Identify the spatial geometry of the 4-brane with Minkowski 4-space, as described above.
- Interpret the imaginary axis of the quantum state as the fourth (imaginary) spatial dimension, and time as emerging from motion on the imaginary axis.
- Reformulate Quantum Mechanics while taking into account the above criteria.
- Beyond the reinterpretations and extensions to Minkowski space described above, Special Relativity remains untouched.

14. What is the Wavefunction?

I have proposed that the wavefunction is an entity extended in four spatial dimensions in a four-dimensional space. I have further suggested that it embodies negative energy states, and hence exploits the spacelike, nonlocal properties of Minkowski 4-space. But what exactly *is* the wavefunction?

If M/String Theory is correct in concluding that only gravity can travel between branes, and if the brane model indeed reflects Nature, this would suggest that the wavefunction is a gravity wave. In principle, gravity waves could exist at any frequency [13]. According to this model, the gravity waves carry (negative) energy into the 3-brane and excite quantum fields in 3D space. Hence, wavefunctions in the 4-brane could be understood as "playing" the quantum fields, giving rise to all matter and phenomena in the 3-brane.

When the negative-energy wavefunction interacts with the positive-energy quantum fields, the Minkowski 4-space metric is "rotated" (in effect, each term is multiplied by i), yielding the metric for time experienced in our (3 + 1) spacetime. Much of the complexity in quantum theory surrounds this interaction of the wavefunction with the 3D quantum fields. In this paper I will resist entering further into this subject, however, choosing to focus our attention on the primary entity, being the wavefunction itself.

It is conceivable that the wavefunction is clothed in some type of matter in the 4-brane, while retaining its holistic, nonlocal properties by virtue of spacelike Minkowski (4 + 1) spacetime. Such a "material" wavefunction would be confined to the 4-brane, however. Given the conventional theory of branes, a mechanism involving gravity is required to make contact with the 3-brane.

The wavefunction is a bridge between worlds, a bidirectional "information conduit", since we are constantly manipulating wavefunctions with every action we take. When an experimenter sets up an experiment involving a photon, for instance, the configuration of the experiment determines the photon's wavefunction. If the experimental configuration is changed, the wavefunction dutifully obliges and

changes with it. If the experimenter performs a measurement, the wavefunction irreversibly collapses then continues to evolve from the reduced state (this is explained further in the next section). Hence, the wavefunction in the 4-brane *adheres* to matter in the 3-brane while at the same time *informing* matter in the 3-brane. Though of different spaces, different worlds, the wavefunction and physical matter are inseparable. The wavefunction, or quantum state, is the mechanism that binds the worlds together.

15. State Reduction and Consciousness

According to the orthodox ontology of quantum theory, the wavefunction evolves in time deterministically according to the Schrödinger equation until a "measurement" takes place. The wavefunction is considered as a superposition of all possible outcomes of a measurement, defined by operator eigenfunctions of the state. When a measurement takes place, the wavefunction reduces probabilistically to one of the possible outcomes, then continues evolving from the reduced state. The other possible outcomes are lost. This process is variously called *collapse of the wavefunction* or *reduction of the state*.

Upon measurement, the probability of a particular outcome is defined as proportional to the squared modulus of the wavefunction amplitude corresponding to that outcome. Using the nomenclature of Figure 1, for the amplitude $\psi = u + iv$ the squared modulus is defined as:

$$|\psi|^2 = u^2 + v^2$$

Note that the squared modulus does *not* correlate with the metric for Minkowski 4-space, which *subtracts* the imaginary component (w). This does not necessarily indicate an inconsistency in the scheme, however; to the contrary, it may be revealing further subtleties of the imaginary dimension involving an inverse relation between displacement and energy.

In 1932 the eminent mathematician John von Neumann published a rigorous logical analysis of the process of "measurement" in Quantum Mechanics and came to a bizarre conclusion. He found that a detector or instrument "measuring" a superposed state will itself become a superposition of states, as will any device "measuring" that detector, and so on. This "von Neumann chain" continues indefinitely until the entire system is "collapsed" by a human observer to just one of the possible outcomes. To quote quantum physicists Bruce Rosenblum and Fred Kuttner:

> **Von Neumann showed that *no* physical system obeying the laws of physics (i.e. quantum theory) could collapse a superposition state wavefunction to yield a particular result… Von Neumann concluded that only a conscious observer doing something that is not encompassed by physics can collapse a wavefunction. Only a conscious observer can actually make an observation.** [14]

This theoretical conclusion led to the famous "Schrödinger's cat" paradox, according to which an unobserved cat could be placed in the superposition state of being simultaneously alive and dead! In an attempt to resolve this paradox some physicists have searched for an "objective reduction" mechanism that is not dependent on a human observer, and various such mechanisms have been proposed [15]. Regardless of whether objective reduction mechanisms exist in Nature, however, the fact remains that a human observer (consciousness) *does collapse the wavefunction* whereas other natural interactions generally do not.

This unexpected (and for most physicists, unwelcome) collision between physics and consciousness is known as the *Measurement Problem*. It is the preeminent quantum mystery. The distinguished physicist and Nobel laureate Eugene Wigner expressed this mystery as follows:

> **It is not possible to formulate the laws of quantum mechanics in a fully consistent way without reference to the consciousness… It will remain remarkable in whatever way our future concepts may develop, that the very study of the external world led to the conclusion that the content of the consciousness is an ultimate reality.** [16]

Accordingly, a direct reading of quantum theory and experimental facts leads us inescapably to the following conclusion:

- Any consistent framework for the unification of physics must include consciousness.

Part 2: Consciousness

16. A Note on Admission of Testimony

Is this the end of the road in our quest to unravel the quantum mysteries? As quantum physicist Nick Herbert has observed, consciousness defies description and explanation:

> **Science's biggest mystery is the nature of consciousness. It is not that we possess bad or imperfect theories of human awareness; we simply have no such theories at all. About all we know about consciousness is that it has something to do with the head, rather than the foot.** [17]

Indeed, since our universe is considered a closed system, it is generally assumed that consciousness is a physical phenomenon somehow *produced* by the brain, and consequently there has been much speculation about possible quantum mechanisms in brain biology [18]. But the "hard" problem of consciousness is: *how do physical processes produce conscious awareness*, in particular the phenomenon of self-reference, the ability to say "I am"? Here I take a different approach to resolving the problem of consciousness.

We have determined that the wavefunction lives in a 4-brane. We have also determined that consciousness directly influences the wavefunction in a manner that other natural processes do not. Therefore we ask: Is it not possible that consciousness also lives in the 4-brane? In fact, there exists a sophisticated model of consciousness which insists that this is so. According to this ancient understanding, our consciousness is not of the 3-brane, but is related to higher dimensions of space. While this idea may not fit with standard scientific theory, the reader may be surprised to discover that this ancient model does fit the facts.

It is a curious feature of contemporary physics that wild speculation is freely admitted – even encouraged – while subjective (psychological) testimony generally is not. This paper is within the discipline of physics, and the author is well aware that we have come to the edge of an ideological precipice. For several centuries science has been directly investigating our physical universe (the 3-brane), and the scientific method has appropriately demanded that only *physical, empirical* evidence gains admission in science. In investigating the 4-brane, however, we have departed the realm of experimental physics, since our physical senses and instruments are inevitably confined to the 3-brane. In principle, we may observe the *effects* of the 4-brane but never the 4-brane itself. What are we to do?

M/String Theory has encountered a similar predicament, being a mathematical structure having no connection to current experimental physics. How serendipitous, then, that in the absence of experimental contact, M/String Theory finds direct support from what I will call the *esoteric model*, which can be consistently identified in the Vedas and Upanishads of ancient India (investigated by no less than Erwin Schrödinger [19]), in the writings of the Greek philosophers and the Christian Gnostics, in the Hebrew Kabbalah, and throughout the various mythologies and scriptures of the ancient world – when correctly extracted from behind the veils of time, language and allegory, of course.

The esoteric model represents the consistent testimony of countless gifted human beings who, over the ages, have explored the higher spatial dimensions – in their *consciousness*. While many parallels have been drawn between modern physics and the psychological and philosophical aspects of mysticism [20], little attention has been given to *esoteric cosmology*. The reason is straightforward: the exoteric (orthodox) traditions do not have this knowledge in their possession. The human mind has difficulty conceiving of multidimensional spaces, which happen to form the backbone of the esoteric worldview; consequently the pure testimony is invariably recast in material or anthropomorphic terms, the literal meaning lost. While Plato, the rational mystic, pointed to the inner spaces as "real", with the material world being a mere shadow, his pupil Aristotle pointed to matter as "real", heralding two millennia of materialistic religious and scientific thought. I wonder if Plato would have been happy with his pupil.

Today, physics is leading us inexorably out of our materialistic mindset, back to the contemplation of multidimensional spaces. Perhaps string theorists will find some reassurance in the following little-known but truly remarkable fact:

- The esoteric tradition upholds the existence of six extra dimensions of space, with all nine dimensions existing within a larger higher-dimensional space.

To spell this out, the esoteric model is in *precise numerical agreement* with the spatial dimensions required by M/String Theory and other supersymmetric theories such as 11D Supergravity. Is this simply an unlikely coincidence, or is it a confluence of human knowledge of profound proportions? Given that the esoteric tradition has taught the presence of these extra spatial dimensions for some millennia, might it bring further insights to the intractable problems currently confronting physics?

In order to address these questions I must introduce some basic and universal elements of the esoteric model, undisputed in the genuine esoteric literature and directly related to the task at hand. The author would be happy to claim this model as his own, but credit must be given where credit is due. The reader is invited to consider the next section (along with everything derived from it) as a speculative hypothesis, to be evaluated for its consistency and explanatory power. The foregoing arguments stand on their own.

17. Elements of the Esoteric Model

Universal esoteric models [21] have seven "planes of being" of increasing dimensionality, materially isolated yet comprising a unified spatial structure (enfolded and interpenetrating). The lowest plane (brane) is our three-dimensional physical space, while the highest is a nine-dimensional space, all occupying a higher-dimensional "cosmic" space. Each plane (brane) embodies higher vibrational frequencies than the plane below it. We will confine our descriptions to the lower three planes (known in Sanskrit as *Tripurā*, "the three worlds"), since according to the model they encompass the sum total of the natural human experience and are those directly relevant to physics (being the natural law of the 3-brane).

The brane (plane) "nearest" our physical universe – the 4-brane – was known in ancient Sanskrit as *Alaya-Vijñāna*, "storehouse-consciousness", and as *Kāma-Loka*, "desire-realm". Today it is often called the *astral* plane. It is a world of emotion and feeling and the repository of long term memory – both personal memory and the memory of the physical universe. In psychological terminology it is the realm of the *subconscious mind*, which is conceived as an objective form (or localized field) in the 4-brane. Through our feelings, emotions, desires, expectations, imagination, habits and memories we are continually in (subjective) rapport with the 4-brane, reliving the impressions of the past while imposing new impressions back into the record. During sleep we enter the 4-brane in our dreams.

The 5-brane is known in Sanskrit as *Manasa-Loka*, "the mental realm". It is considered a highly complex space, being divided into a lower region containing objective forms and a higher *formless* realm. The lower region (i.e. of lower vibrational frequencies) embodies our ordinary, rational, logical mind; it constitutes our

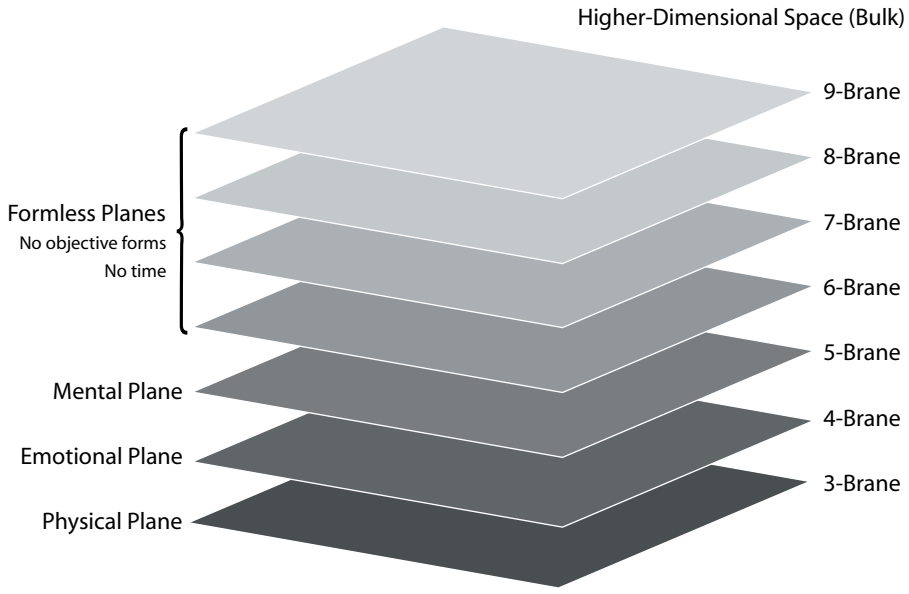

Figure 4: Brane representation of the esoteric model. Shown stacked for clarity, each of the branes occupies the same higher-dimensional space.

thought-space, wherein our thoughts take objective form. The higher, formless space corresponds to what is called *abstract* mind, being the source of scientific, mathematical or philosophical *insight*. The abstract mind is also known as *higher* mind or *intuitive* mind, while the ordinary rational mind is considered as *lower* mind.

This idea of "formlessness" must be approached with care. It refers to the absence of objective, three-dimensional forms as found in the realms below. Rather, the "forms" in this abstract space are of higher dimension, hence beyond our natural conscious capacity to perceive as "objects". The abstract "forms" in this higher mental realm are known as *Archetypes* or *Ideas*, as described by Plato.

Accordingly, we are each functioning (subjectively) in the 5-brane whenever we experience a thought, and our lower mind and thoughts are objective realities (or fields) in the 5-brane. When *insight* comes (when the lower mind is suitably prepared, calm and poised), the "eternal archetypes" are reflected into the lower, rational mind-space as objective thought-forms. Herein lies the mechanism behind all true genius.

Scientists and mathematicians have long wondered at "the unreasonable effectiveness of mathematics in the natural sciences" (as expressed by Eugene Wigner). Roger Penrose has expressed this mystery as follows:

> **There often does appear to be some profound reality about these mathematical concepts, going quite beyond the mental deliberations of any particular mathematician. It is as though human thought is, instead, being guided towards some external truth – a truth which has a reality of its own, and which is revealed only partially to any one of us.** [22]

According to the esoteric model, the formless realms of the 5-brane are experienced as pure insight, pure geometry, pure mathematics, pure music, perfect order and harmony, the Archetypes being the "Thoughts" underpinning the manifest Universe (the four higher branes being "unmanifest", or manifesting purely as energy and consciousness). Hence this realm is also known as the *Causal World*, constituting the primary causal basis for all manifestation. The Hebrew Kabbalists named this realm *Tiphareth*, translating as "Beauty". Every great mathematician, scientist, philosopher and composer has experienced this Beauty at the heart of manifestation. The following is attributed to Albert Einstein (source unknown):

> **The intuitive mind is a sacred gift and the rational mind is a faithful servant. We have created a society that honors the servant and has forgotten the gift.**

The esoteric model considers the 5-brane (the mental universe) and the 3-brane (our physical universe) to be of *positive* polarity, whereas the 4-brane is of *negative* polarity, meaning *receptive*. The 4-brane space is known as *Akasha* in Sanskrit, translating literally as "space" (note that the word is applied in other contexts as well). According to the ancients, Akasha is not just a plenum but a living ocean of potentiality. Akasha is *receptive* in the sense that it records enduring impressions of all that transpires within it, and dutifully brings life to all forms imposed upon it. Hence the 4-brane is generally personified as *feminine* in mythology (witness the Greek Goddess *Persephone*, queen of Hades).

In the esoteric understanding, space and consciousness are dual, being two sides of the same thing: consciousness is the subjective aspect while space is the objective aspect. This applies to your own consciousness-space as it applies to the Universe. The great Russian esotericist H.P. Blavatsky explains:

> **There is but one indivisible and absolute Omniscience and Intelligence in the Universe, and this thrills throughout every atom and infinitesimal point of the whole finite Kosmos which hath no bounds, and which people call Space, considered independently of anything contained in it.** [23]

Space and consciousness are considered primary, while time is derivative, emergent, illusory. In the higher branes time disappears altogether, replaced by something called *eternal duration*, which does not "flow". The arrow of time exists only where objective form exists. Herein lie important clues for physics.

It must be made clear that the esoteric science bears no resemblance to common psychism, clairvoyance, mediumship, channeling, shamanism, or fundamentalist religion, all of which involve *subjective* impressions of the 4-brane. The subconscious mind manifests itself objectively in the 4-brane; hence the natural human consciousness cannot distinguish between objective and subjective phenomena in the 4-brane. This simple fact has led to unfathomable misinformation, confusion, obsession, fanaticism, persecution and suffering

down through the ages, and does so to this day. It is for good reason that the *Rishis* (Seers) of ancient India called the 4-brane *Mahā-Māyā*, "the great delusion". Just as there is science and pseudo-science, there is esotericism and pseudo-esotericism, and in each case the two are like light and darkness.

If the 4-brane appears to be a problem for humanity, it certainly is, but it is also the foundation of our physical existence. In fact, the Hebrew Kabbalists called the 4-brane *Yesod*, "Foundation", being the substratum of our objective physical universe, without which our objective human experience and consequent evolution of consciousness could not occur. To transcend the 4-brane (our personal and collective subconscious, our past), we must come to *understand* its vicarious ways.

Many readers will be challenged by these proposals, of course, and some will dismiss them out of hand, since they fly in the face of deeply entrenched assumptions (our collective subconscious, in the 4-brane) going all the way back to Aristotle. If indeed we seek knowledge, however, we must stand back from our assumptions and rationally consider the facts, which I summarize as follows:

- The esoteric model of consciousness is elegant and consistent, with great explanatory power.
- The model is universal, being consistently reflected in esoteric teachings isolated in time and space.
- The model is consistent with the current framework, which is derived from acknowledged theoretical and experimental facts.
- The model is dimensionally compatible with current mathematical models in physics, such as M/String Theory and 11D Supergravity, and is consistent with the theory of branes.
- The model provides a framework for explaining psychological and parapsychological phenomena.
- The model provides a framework for resolution of the Measurement Problem.
- There is no obvious empirical evidence contradicting it.

On this basis we will proceed to investigate what insights the esoteric model of consciousness might bring to physics, and to the outstanding mysteries of quantum theory in particular.

18. The Measurement Problem Revisited

The esoteric correlation between the higher spatial dimensions and consciousness provides an essential mechanism for resolving the Measurement Problem. According to the model, the subconscious mind lives in the 4-brane – as does the wavefunction. They are both of the same "stuff". When an experimenter makes an observation, her subconscious mind becomes *entangled* with the wavefunction – that is to say, while separated in physical space they in some sense share the same *space* or *frequencies* in the spacelike 4-brane, through which they are in direct rapport. It is clear that within this framework consciousness could conceivably interact with the wavefunction, and hence with matter. As J. Krishnamurti and many others have said: "The observer is the observed."

In fact, if space and consciousness are dual as the esoteric model suggests, gravity waves (which are oscillations of space itself) could be understood as the objective language of consciousness. Hence, if the wavefunction is indeed a gravity wave, it could be said to possess consciousness of some very primitive order. In some sense, even an electron is "conscious". This would justify the esoteric adage that "Everything lives and everything is conscious, but not all life and consciousness is similar to the human." [24]

One might ask why the subconscious mind, rather than the conscious mind, should interact with the wavefunction. Modern psychology and the esoteric model concur that the subconscious mind is in fact very conscious and fully attentive – far more attentive than the conscious mind, in fact – but operating below the surface of our normal awareness. Subliminal effects are well known in psychology (and in marketing!) and provide a more direct route to state reduction than one requiring conscious awareness. This would lend support to the philosophical position that our subconscious fears, desires and expectations, with feeling, create our experience.

This does not preclude the possibility of higher dimensions of consciousness interacting with the wavefunction. Consciousness, being the other side of gravity, can pass freely throughout the higher dimensions and throughout the branes. Investigation along these lines may yet uncover the natural law underlying "miracles" as displayed by highly conscious people down through the ages.

19. The Implicate Order

The deeply insightful (and much misunderstood) quantum physicist David Bohm conceived of an "implicate order" *enfolded* into the "explicate order", our physical world. Following from our previous descriptions, this is certainly a suitable way to describe the complex-space 4-brane interpenetrating our 3-brane. Bohm writes in his book *Wholeness and the Implicate Order:*

> **In the enfolded order, space and time are no longer the dominant factors determining the relationships of dependence or independence of different elements. Rather, an entirely different sort of basic connection of elements is possible, from which our ordinary notions of space and time, along with those of separately existent material particles, are abstracted as forms derived from the deeper order. These ordinary notions in fact appear in what is called the *explicate* or *unfolded* order, which is a special and distinguished form contained within the general totality of all the implicate orders.** [25]

Perhaps the reader will understand Bohm's insights from a fresh perspective in the context of the current framework. In principle, every location in the vast spacelike 4D space (the implicate order, the 4-brane) is equally accessible. It would appear that one navigates this nonlocal space not in spatial terms, but by way of *resonance* or *sympathetic vibration*. The unconventional and sometimes heretical views on quantum theory espoused by David Bohm and Albert Einstein, among others, can be seen in a new light in the context of the current framework.

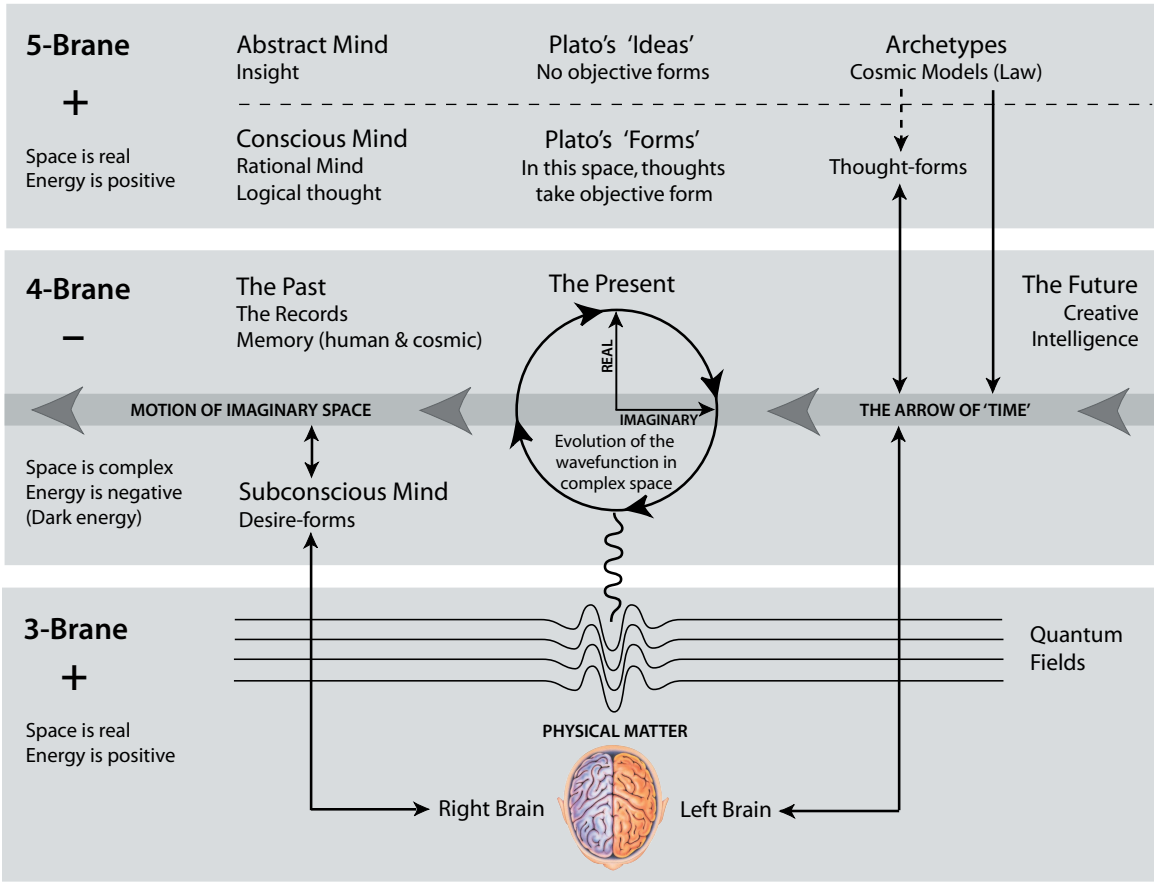

Figure 5: The wavefunction, time, and the esoteric model

20. The Complex Passage of Time

Figure 1 (page 6) schematically illustrates the wavefunction at one moment of time. As the wavefunction evolves in time it spirals through 4D space, repeatedly moving in and out of the real and imaginary dimensions while oscillating between "past, present, and future" in imaginary space. What are we to make of this? I suspect that the deepest mysteries of quantum theory lay hidden here. What might be mathematically revealed when Quantum Mechanics is reformulated to properly reflect the relationship between the imaginary dimension of the quantum state and time? In particular:

- Does this "oscillation in time" explain the origin of quanta?
- Does this imply that time in the 3-brane is discrete?

Figure 5 (page 18) illustrates this process as it relates to consciousness. Our thought-space (the 5-brane) is oriented to the future – it plans, organizes, creates and conspires according to its own designs. Our feeling-space (the 4-brane) is oriented to the past – in fact, it is an embodiment of our past, and the past of the entire physical universe. It is suggested that, as the wavefunction evolves in time, it *samples* the future, *manifests* itself in the present, and *impresses* itself upon the past. At each turn of the spiral the wavefunction has moved through the imaginary dimension, leaving behind it an eternity of records etched into 4D space. According to this model our conscious purpose can (in some sense) influence physical events. If there is no conscious influence, events are determined by the past – that is, by habit. This applies to a human being as it applies to the universe. David Bohm intuited this process as follows:

> **In terms of the totality beyond time, the totality in which all is implicate, what unfolds or comes into being in any present moment is simply a projection of the whole. That is, some aspect of the whole is unfolded into that moment and that moment is just that aspect. Likewise, the next moment is simply another aspect of the whole. And the interesting point is that each moment resembles its predecessors but also differs from them. I explain this using the technical terms "injection" and "projection". Each moment is a projection of the whole, as we said. But that moment is then injected or introjected back into the whole. The next moment would then involve, in part, a re-projection of that injection, and so on indefinitely.** [26]

Bohm would no doubt be surprised but delighted to learn that the mechanism for this "injection and projection" process is built right into the wavefunction itself, along with the motion of the imaginary dimension which manifests as time – what Bohm called the *holomovement*. [27]

Note that Figure 5 is not precise in its details. For instance, while the subconscious mind is aligned to the past, and the conscious mind is aligned to the future, both can act only in the present moment. According to the esoteric understanding, in fact, the past and future are not "real": Reality is always only *now*.

We have found that *objective* time corresponds to motion in imaginary space. It is proposed that our *subjective* sense of time arises from the interplay between our future-aligned rational mind and our past-aligned subconscious mind, and the resulting sense of causality and continuity revealed to us by our senses. As the mystics of all ages have claimed, when we stop the movement of the mind – both minds – subjective time stops.

21. Quantum Chance and Determinism

According to the orthodox (Copenhagen) ontology of Quantum Mechanics, the quantum state encodes everything that can be known about a quantum entity; there is nothing else to be known about it. Hence, probabilistic quantum phenomena are subject to statistical law and nothing else. Einstein never accepted this, of course, famously saying, "God does not play dice with the universe."

The current framework brings two key insights to statistical phenomena in quantum theory:

- The energy carried by a classical wave is proportional to the square of its amplitude. By analogy, if the wavefunction is indeed a negative-energetic 4D gravity wave, it is suggested that the squared modulus of the wavefunction's amplitude relates to its energy, and hence that the probabilistic weightings are proportional to the energy carried by the wavefunction.

- Through the imaginary fourth dimension the wavefunction is entangled with its entire past, along with the past of any system with which it is entangled. This opens the possibility for the *determination* of specific events while facilitating adherence to statistical law for multiple events.

Accordingly, it is proposed that the fourth dimension of the wavefunction (the dimension that can never intrude into our 3-brane) provides a mechanism for the determination of what are now considered purely probabilistic quantum phenomena. Einstein may have been right: perhaps God does not play dice after all? According to this proposal:

- The physical (three-dimensional) configuration of a quantum system determines the possible outcomes of a measurement on the system, being those adhering to physical law, conservation laws in particular.
- The fourth (imaginary) dimension of the wavefunction precipitates the collapse of the wavefunction and determines what outcome actually takes place. The determination is made in response to past influences (habit) and "future" influences (creative purpose, human or cosmic) which are impressed upon the "future" axis of imaginary space in the 4-brane. Since the wavefunction is always entangled with its entire history, the mechanism allows for multiple events to adhere to statistical law.

Consequently, we experience a stable and enduring physical universe, circumscribed by undeviating physical law, yet one amenable to ordering guidance from the 4-brane (the past) and from the 5-brane (the future, or conscious purpose). The esoteric model considers the Archetypes to embody the *law* and *model* for manifestation, or what the manifest universe, and everything in it, is evolving *towards*. Within this context, however, human beings remain intrinsically *free* and *creative* – we can and do manifest what is in our minds, whether or not our thoughts are aligned to the Archetypes. Animals do not possess mentality, however, since they have no *conscious* connection to the 5-brane; hence their behavior is dominated by the accumulated experience of the species, stored in the records in the 4-brane. (See Section 23.)

Beyond these considerations, there remains the possibility that probabilistic law in quantum theory could be overruled by (as yet unrecognized) causal factors within Nature. For instance, future quantum experiments may yet reveal that the statistical predictions of quantum theory do not always hold in the context of living systems. While this must remain a conjecture, it has yet to be shown otherwise.

22. Accord with Psychology

The current framework provides a context for all aspects of psychology, both animal and human. The 4-brane constitutes what the great psychologist Carl Jung called the "collective unconscious". Our individual subconscious minds are like bubbles or local specializations in the "universal subconscious mind", being the 4-brane. Similarly, our conscious, rational minds are local specializations in the 5-brane. Mental and emotional people generally don't understand each other because they are literally in different "spaces" (their attention is focused in different branes), while neither can relate to the *genuine* mystics and adepts, those few who have learned to focus their attention in the higher-dimensional branes.

A broad spectrum of parapsychological phenomena can be attributed simply to the following: [28]

- The subconscious mind lives in the 4-brane, which is a complex nonlocal (spacelike) space.

Perhaps the most common experience of the 4-brane is available to those who have vivid dreams. According to the esoteric model, while *ordinary* dreams are subjective experience of one's own subconscious mind, *vivid* dreams are *objective* experience of the 4-brane – one is experiencing what is actually present in the 4-brane, beyond one's subconscious mind (or more generally a mixture of both). Accordingly, those who have vivid dreams are already familiar with the 4-brane, and most would agree that this spacetime exhibits both local and nonlocal properties. One can move around freely, or fly through space, or sometimes be anchored to the spot, or in a flash be half way around the world. These phenomena lend subjective support to our theoretical conclusion that the 4-brane facilitates both local and nonlocal displacements, yielding a sense of time and motion very different from our experience in the 3-brane.

While such subjective experience can bring valuable insight to the individual "experimenter", genuine objective knowledge of the higher-dimensional branes requires long and intensive training, as taught in the

great esoteric and mystical traditions throughout history – including the mystery schools of ancient Greece, which (according to the esoteric lore) the great Greek philosophers knew well but were not permitted to fully reveal. Western history reveals that the true "knowers" (Gnostics) have too often come to a bad end (witness the fate of Socrates and Bruno, to name just two, along with the Gnostic Christians themselves), while such knowledge in the hands of the unready was considered akin to fire in the hands of children.

While physics obviously must take subjective testimony with a large dose of discrimination, ultimately we will come to accept that "permissible evidence" depends upon the realm we are exploring. If our physical senses and instruments cannot penetrate our sphere of interest, we are left with no choice but to consider what can. Speculation alone cannot be considered a reliable guide.

Note that the word *esoteric* is from the Greek *esōterikos*, meaning "inner, hidden, beyond the reach of the physical senses". By definition, where physical science leaves off, esoteric science begins. Perhaps the day is near when again the physical and esoteric sciences will walk hand in hand as they did in ancient Greece, each empowered by the complementary discipline, for the upliftment of human knowledge.

23. Accord with Biological Theory

The innovative and insightful biologist Rupert Sheldrake argues that certain biological processes cannot be explained by known physics. He postulates the existence of organizing fields in Nature, guiding the physical development and behavior of living systems. In his book *Morphic Resonance* he writes:

> **Whereas morphogenetic fields influence form, *behavioral fields* influence behavior. The organizing fields of social groups, such as flocks of birds, schools of fish, and colonies of termites, are called *social fields.* All these kinds of fields are *morphic fields.* All morphic fields have an inherent memory given by morphic resonance.** [29]

After reviewing possible physical theories to explain these morphic fields, he concludes that "at present no one knows how the phenomena of morphogenesis are related to physics, whether conventional or unconventional" [30]. Sheldrake reasons that because these fields behave nonlocally they must be non-energetic. This conclusion would be premature if the fields have their basis in the spacelike 4-brane.

What Sheldrake calls *morphic resonance* is associated with nonlocal *sympathetic vibration* and *memory*. According to Sheldrake's theory, living things "resonate" with morphic fields of sympathetic vibrational frequencies, hence drawing from the collective memory of the species, race, culture, family, or any coherent grouping, while simultaneously feeding back into it. He writes:

> **By morphic resonance the form of a system, including its characteristic internal structure and vibrational frequencies, becomes *present* to a subsequent system with a similar form; the spatio-temporal pattern of the former *superimposes* itself on the latter.** [31]

The current framework provides a clear basis for these ideas. Behavioral fields in the 4-brane would constitute a common "subconscious mind" or "mindset" in groups of animals or people (corresponding to what biologist Richard Dawkins calls *memes* [32]). The esoteric model points to subtle physical fields playing a vital role in morphogenesis, the physical fields themselves adhering to fields in the 4-brane [33]. These fields conceivably could guide the development of forms in the 3-brane through state-reduction processes as alluded to in this paper.

Recall that the higher-dimensional branes coincide with our three spatial dimensions; our conscious and subconscious minds are higher-dimensional fields interpenetrating the physical body and thus could conceivably influence state reduction in the body, providing the essential mechanism for the interaction of mind and brain. This question could ultimately be decided by quantum experiments in conjunction with living systems. Henceforth, the scientific problem of understanding how the brain "creates" consciousness becomes the somewhat more tractable problem of how the brain (and the body generally) bidirectionally *interacts* with consciousness. That process is miracle enough, and sufficient to keep brain scientists and biologists busy for the foreseeable future.

24. Many Worlds

The notion of "many worlds" or "multiple universes" has become a recurring theme in physics. In 1957 Hugh Everett published his *Many Worlds* interpretation of Quantum Mechanics, while more recently we have the *Landscape* and *braneworlds* of M/String Theory. This paper would not be complete without a brief mention of each.

Everett's proposal is an attempt to get around the Measurement Problem by claiming that all possible outcomes of a measurement on a superposed state do in fact occur. Supposedly, upon "measurement" the universe splits into multiple copies, identical except for the differing outcomes of the measurement, and "you" just happen to be in one of them. Further, each parallel universe continues to split, generating exponentially increasing numbers of parallel universes. "You" also exist in these myriads of universes, of course, though you are not aware of the myriads of other "yous".

Perhaps the most surprising feature of this proposal is that many physicists apparently subscribe to it. But not all. Astrophysicist Bernard Haisch comments on Everett's proposal as follows:

> **To put it bluntly, some scientists are willing to "create" a veritably infinite number of alternate universes to avoid admitting that consciousness plays a the role in the operation of our universe. These infinite alternate universes, populated by infinite duplicate beings are, they think, a small, or at least acceptable, price to pay for maintaining their belief that nature is devoid of genuine consciousness or purpose… Indeed, I think it is fair to ask: Isn't the Many Worlds interpretation of quantum mechanics more outrageous than even the most spiritual worldview?** [34]

Upon reflection, Everett's proposal does not solve the Measurement Problem at all. The fact remains that when a quantum measurement (human observation) occurs, the wavefunction collapses to a particular outcome, then continues to evolve from the reduced state (or at least it appears to do so in *this* world). If there were no measurement (observation), there would be no reduction of the state, and the superposed state of all possible outcomes would continue to "exist" in this world. Your choice to make a measurement irreversibly changes the world (this world) – and according to Everett's theory creates multiple universes as well, each evolving from its own reduced state. The *Many Worlds* interpretation in fact makes the Measurement Problem a dramatically bigger problem. Roger Penrose concurs:

> **I have to say that I find this viewpoint very unsatisfactory. It is not so much the extraordinary lack of economy that this picture provides – though this is indeed a worrying feature, to say the least. The more serious objection is that the viewpoint does not *really* provide a solution of the "measurement problem" that it was set up to solve.** [35]

Furthermore, there is the serious philosophical question of what constitutes "you". If you make an exact biological copy of yourself, would that copy also be "you"? If so, why are you not aware of all the other "yous" in the parallel universes? If you are not aware of them, could they really be considered to be "you"? What is "you"? As Erwin Schrödinger writes in his essays on *Mind and Matter*:

> **The doctrine of identity can claim that it is clinched by the empirical fact that consciousness is never experienced in the plural, only in the singular. Not only has none of us ever experienced more than one consciousness, but there is also no trace of circumstantial evidence of this ever happening anywhere in the world. If I say that there cannot be more than one consciousness in the same mind, this seems a blunt tautology – we are quite unable to imagine the contrary… Even in the pathological cases of a "split personality" the two persons alternate; they never hold the field jointly.** [36]

It comes down to our subjective conviction of identity, of being able to say "I am". "I" is singular. If the parallel universes don't actually contain "you", they are not true copies and Everett's theory fails.

According to the current framework, state reduction is what it appears to be: the wavefunction collapses to just one of the possible outcomes, then continues to evolve from the reduced state. But here is the difference from the orthodox ontology: the alternative outcomes are not "lost". The entire evolution of the wavefunction through time is imprinted into the records in the 4-brane, by which the wavefunction

is entangled with its past. The wavefunction's past can therefore influence its behavior in the present, providing a key mechanism towards understanding the statistical properties of state reduction.

The *Landscape* of M/String Theory [37] also has the flavor of trying to make reality fit our theories. This idea constitutes the fortuitous marriage of two intractable problems: the "fine-tuning" problem (why is the universe so perfectly adjusted to produce life?) [38], and the unwelcome realization that String Theory comes in something like 10^{500} versions (that is 1 followed by 500 zeros). A variation of Big Bang theory called *Eternal Inflation* provides an ongoing supply of myriads of universes, each of which is supposedly described by some version of String Theory. Given enough universes, eventually one will come along that works. Because we are here to observe this universe, it is obviously one of those fortuitously tuned to support life (a line of reasoning known as the *Anthropic Principle).* We can never observe the myriads of universes, since they are "beyond the horizon", so distant that even their light cannot reach us. Hence the theory is safely immune from contradiction; we can never prove that these myriads of universes don't exist. So we have to resort to common sense. If we were to select a fundamental theory of the universe for its elegance, beauty and economy, the Landscape clearly is not it. How far will we go to avoid considering that there may be Intelligence in the universe – other than our own? Is it logical to consider ourselves more intelligent than the universe which produced us?

Braneworld scenarios envisage our (3 + 1) universe as a 3-brane occupying a higher-dimensional space along with other branes, presumably similar to ours. Once again, these "other worlds" are in principle inaccessible to us; the braneworlds are isolated worlds, in contrast to the unified spatial structure of the esoteric model. With this proliferation of inaccessible worlds, human beings shrink ever smaller, accidental features in a vast, meaningless cosmos, forever cut off from the universal reality. Moreover, none of these theories explains our physical universe – other than by the sheer force of statistics, which is lame.

I believe it was Samuel Taylor Coleridge who penned the words: "Beauty is unity in diversity." This is a human sensibility, not an equation. Throughout history the Sages and true Philosophers (lovers of wisdom), from Parmenides to Krishnamurti, have exhorted us: "There is only the Oneness!" This is the universal experience of those who have penetrated the higher branes. The current framework brings theoretical support to the existence of *one multidimensional space*, understood as a unified spatial structure enfolding many dimensions and worlds (subspaces), each with its own law, consciousness and matter. Hence, according to this model, there are indeed *many worlds*, but they are not far away "out there". We are not isolated from them; they are permeating us through and through. We are already *in* them and *participating* in them through our consciousness.

The author concludes that this constitutes the fundamental intellectual leap required of us if we are to solve the big problems confronting physics and make sense of our human existential predicament.

25. Scientific and Philosophical Implications

If just the essential consequence of the current framework is found to reflect Nature – that is, if the quantum state indeed occupies an interpenetrating 4-brane – the philosophical implications for science and for humanity are fundamental. We will have to radically modify our worldview.

In his book *Three Roads to Quantum Gravity*, theoretical physicist Lee Smolin presents what he calls "the first principle of cosmology" as follows: [39]

> **There is nothing outside the universe.**

Certainly, nobody could disagree with this, assuming we accept the literal translation of the Latin word *universe*, "turning into oneness" or "revolving oneness". Logically, what could exist outside of the Oneness? Smolin continues:

> **This is not to exclude religion or mysticism, for there is always room for those sources of inspiration for those who seek them. But if it is knowledge we desire, if we wish to understand what the universe is and how it came to be that way, we need to seek answers to questions about the things we see when we look around us. And the answers can involve only things that exist in the universe.**

The implication is clear: the "universe" is understood as our *physical* universe, "the things we can see when we look around us," and knowledge can come through our physical senses alone. This indeed is the orthodox scientific ontology that has driven its progress for several centuries. Since Galileo and before, empirical science has progressed on the basis of empirical evidence (logically enough), demanding sensory information gleaned from instruments in our (3 + 1) spacetime. Anything else is speculation. Over the centuries, however, this legitimate quest for empirical knowledge by the early scientists has quietly morphed into the scientific conviction that "there is nothing outside the physical universe" – constituting the heavily entrenched scientific-materialistic mindset that few scientists can escape. So then, what are we to do when our observations cannot be explained from within our (3 + 1) spacetime?

A central premise of this paper is that physics is encountering the boundaries of the physical universe and has been doing so since the turn of the 20th century. Logically, to make any sense of our observations, we are forced to enlarge our definition of "universe" to include at least one other higher-dimensional space interpenetrating our own. Our entire multidimensional space – whatever that may be – constitutes the Universe, the Oneness. In short, to solve the fundamental problems of physics we have to look *inside* the physical universe, into the inner dimensions enfolded within our three-dimensional space.

Smolin extends the first principle of cosmology as follows:

> **This first principle means that we take the [physical] universe to be, by definition, a closed system. It means that the explanation for anything in the universe can involve only other things that also exist in the universe.**

Indeed, the conviction that our physical universe is a closed system is fundamental to physics, and few would dare question it. According to the current framework, however, the quantum state constitutes a bidirectional information-conduit connecting our 3-brane to the 4-brane. The wavefunction lives in the 4-brane while shaping itself to physical matter in the 3-brane. It guides the evolution of matter in the 3-brane while recording this evolution in the 4-brane – this constituting the basic mechanism of "habit" in Nature. Consequently, we propose the following principles:

- The multidimensional Universe (understood as a unified spatial structure) is a closed system.
- The physical (3 + 1) universe is an *open* system. (It is constantly exchanging information, and perhaps energy, with other spatial dimensions, other branes.)

This represents a fundamental reorientation for science. Essentially all of science since Galileo and Newton has been under the presumption that our (3 + 1) spacetime is a closed system. While this has become gospel, according to the current framework it cannot be true. As David Bohm has observed:

> **A great deal of work has been done showing the inadequacy of old ideas, which merely permit a range of new facts to be *fitted mathematically* (comparable to what was done by Copernicus, Kepler and others), but we have not yet freed ourselves thoroughly from the old order of thinking, using language, and observing. We have thus yet to perceive a new *order*. [40]**

This new order, this new worldview, is being forced upon us whether we like it or not, for I contend that Nature cannot be explained within the context of our (3 + 1) spacetime alone. This new worldview brings with it far-reaching philosophical consequences. The current framework places physics in a position to establish a very profound fact, simply by establishing that the following proposals hold true:

- Quantum phenomena cannot be explained unless the quantum state exists in a 4-brane interpenetrating our 3-brane.
- The Measurement Problem cannot be resolved unless at least some aspect of human consciousness also exists in the 4-brane.

Having established these facts (and I suspect that physics will do so, given time), physics will have established that human beings are not just biological machines, but multidimensional entities – with all that implies. This will be an historic day for humanity, an historic day for science.

We conclude with some insightful words from Lee Smolin's provocative book *The Trouble with Physics*, as he captures the spirit of scientific revolution:

> **The most cherished goal in physics, as in bad romance novels, is unification. To bring together two things previously understood as different and recognize them as aspects of a single entity – when we can do it – is the biggest thrill in science.**
>
> **The only response to a proposed unification is surprise… Unification instantly turns your world upside down… What you used to believe becomes impossible… Even more important, a new proposal for unification brings with it previously unimagined hypotheses… The implications often extend beyond science….**
>
> **Great unifications become the founding ideas on which whole new sciences are erected. Sometimes the consequences so threaten our worldview that surprise is quickly followed by disbelief.** [41]

26. Conclusion

This paper has outlined a consistent conceptual framework bringing insight to a range of scientific mysteries, including:

- The ontology of Quantum Mechanics.
- Unification of Quantum Mechanics and Special Relativity.
- The nature of time and its emergence from higher-dimensional space.
- The nature of consciousness and its relation to matter.

To the best of the author's knowledge the general structure of the framework is original, perhaps because it emerges from different trainings and perspectives. Expert physicists reading this paper will have noted that the author is not one of them – I thank you for lending me your ears and for forgiving my inevitable indiscretions. As Bruce Rosenblum and Fred Kuttner point out in their book *Quantum Enigma:*

> **The quantum enigma has challenged physicists for eight decades. Is it possible that crucial clues lie outside the expertise of physicists? Remarkably, the enigma can be presented essentially full-blown to nonscientists. Might someone unencumbered by years of training in the *use* of quantum theory have a new insight? After all, it was a child who pointed out that the emperor wore no clothes.** [42]

This paper brings just two fundamental proposals to the table. The first is purely physics, being the proposed framework for unification of Quantum Mechanics and Special Relativity while elucidating time and quantum phenomena. Derived solely from physical principles, this proposal can be fully addressed within the context of physics alone. What might be revealed when Quantum Mechanics is reformulated according to this framework? The proposal is either right or it is wrong. My own conclusion is that the general structure of the framework is too simple and powerful not to be a correct description of Nature. We await the mathematical verdict.

The second proposal is the esoteric model of consciousness, which I present to physics as a worthy and consistent hypothesis. My hope is that this model will be considered alongside others and evaluated for its consistency and power. The author's credentials for presenting these proposals are not that he is expert in either discipline, but that he has some grounding in both. Sadly this remains rare, though no doubt it will become more common in the coming years as physical science establishes beyond doubt the presence of higher-dimensional branes.

However much this framework finds sympathy from Nature, I offer it to the community in the spirit of free enquiry, in the hope that expert theorists and mathematicians will take these ideas to their logical conclusions, modify and develop them as they find necessary, and usher in a new era of progress and discovery in physics.

References

1. For introductory treatments of Bell's theorem and the Aspect experiment, see Herbert (1985), Rosenblum and Kuttner (2006).
2. Bohm (1980), p.237.
3. For popular treatments of brane theory, see Randall (2005), Greene (2005).
4. For a fascinating account of the discovery of imaginary numbers, see Penrose (2005), pp. 249-256.
5. Penrose (2004), p. 509; Penrose (1989), p. 317.
6. Penrose (2004), p. 510.
7. Ibid., p. 414.
8. Ibid., p. 769.
9. Hawking (1998), p. 139.
10. For descriptions of the Hartle-Hawking "no boundary" proposal, see Hawking (1998), pp. 141-146; Penrose (2004), pp. 769-772.
11. Penrose (2004), p. 414.
12. For comments on the mathematical inconsistency of quantum field theory, see Penrose (2004), p. 610, pp. 655-657.
13. See Hawking, S. W. and Israel, W., *General Relativity: An Einstein Centenary Survey*, Cambridge University Press, Cambridge, 1979.
14. Rosenblum and Kuttner (2006), p. 180.
15. For discussion on proposed objective reduction mechanisms, see Penrose (2004).
16. Quoted in Herbert (1985), pp. 25-26.
17. Herbert (1985), p. 249.
18. Possible quantum effects in brain biology are discussed in Penrose (1989, 2005). Various physical models of consciousness are discussed in Walker (2000) and Paster (2006). Horgan (2000) focuses on the dearth of progress in explaining consciousness in biological terms.
19. See Schrödinger (1967) for insights into this great physicist's philosophy of consciousness.
20. See, for instance, Capra (1985), Zukav (1984), Dalai Lama (2005).
21. A coherent introduction to esoteric cosmology can be found in Vallyon (2007), Vol. 1. Compatible accounts of the testimony introduced here can be found in Blavatsky (1888), Heindel (1909), Bailey (1925), Purucker (1935), Laurency (1979, 1985). Laurency is the most "scientific" of these writers, is often brilliant, but is prone to conceptual error (the esoteric wisdom is profoundly subtle and does not take kindly to linear thinking). Bladon (2007) provides a useful compendium but follows after Laurency and falls into the same mistakes. Blavatsky (1888) is a foundational work of profound depth and difficulty; for those who complain that her science is wrong, recall her contemporary Lord Kelvin claiming that physics was essentially solved. Ancient sources (when correctly translated and deciphered) include the Vedas and Upanishads of India, the Greek philosophers, the writings of the Gnostic Christians (see Robinson, 1978), and the Hebrew Kabbalah. Fragments are still recognizable in the Christian Bible ("In my father's house are many mansions…" – John 14:2). Be aware that the literature can be contradictory or simply wrong – like science, the modern formulation of the esoteric model is a work in progress. Scientific readers should keep in mind that esoteric terminology includes many terms later adopted and redefined by science. As in all things, discrimination is required.
22. Penrose (1989), p. 124.
23. Blavatsky (1888), Vol. 1, p. 277.
24. Quoted in Vallyon (2007), Vol. 1, p. 169. Also, Blavatsky (1888), Vol. 1.

25. Bohm (1980), p. xviii.
26. Quoted in Sheldrake (2009), p. 251.
27. Bohm (1980), p. 190.
28. For research and testimony on dreams and parapsychological phenomena, see Talbot (1988, 1991), Radin (2006), Laszlo (2009), among many works in the current literature. Esoteric explanations can be found in Vallyon (2007), Vol. 1.
29. Sheldrake (2009), p. xxii.
30. Ibid., p. xxv.
31. Ibid., p. 85.
32. Dawkins (1989). Note that Dawkins' interpretation of the facts is rather different from the current model, however.
33. For brief esoteric descriptions of these fields, see Vallyon (2007), Vol. 1, pp. 36-39. More detail can be found in Bailey (1925), pp. 77-133.
34. Haisch (2006), p. 136.
35. Penrose (2005), p. 312.
36. Schrödinger (1967), pp. 130-131
37. See Susskind (2006) for a general treatment of the Landscape.
38. For a popular overview of the "fine-tuning problem", see Davies (2008).
39. Smolin (2001), p. 17.
40. Bohm (1980), p. 175.
41. Smolin (2007), pp. 18-19.
42. Rosenblum and Kuttner (2006), p. 13.

Bibliography

Representing a partial list of works influencing development of the current framework.

Augustine, St. (2006). *The Confessions of St. Augustine.* Watkins Publishing, London.

Bailey, Alice A. (1925). *A Treatise on Cosmic Fire.* Lucis Publishing Company, New York.

Barbour, Julian (1999). *The End of Time: the next revolution in physics.* Oxford University Press, New York.

Bauer, Alain (2007). *Isaac Newton's Freemasonry: the alchemy of science and mysticism.* Inner Traditions, Vermont.

Bladon, Lee (2007). *The Science of Spirituality.* Self-published.

Blavatsky, H.P. (1888). *The Secret Doctrine, Volumes 1 & 2.* Theosophical University Press, Pasadena CA.

Bohm, David (1980). *Wholeness and the Implicate Order.* Routledge, New York and Oxon.

Bowman, Gary E. (2008). *Essential Quantum Mechanics.* Oxford University Press, Oxford.

Capra, Fritjof (1985). *The Tao of Physics, Second Edition.* New Science Library, Boston.

Collins, Francis S. (2007). *The Language of God: a scientist presents evidence for belief.* Free Press, New York.

Crick, Francis (1982). *Life Itself: Its origin and nature.* Futura Publications, London.

Dalai Lama, His Holiness the (2005). *The Universe in a Single Atom: the convergence of science and spirituality.* Broadway Books, New York.

Damasio, Antonio R. (1994). *Decartes' Error: emotion, reason, and the human brain.* Grosset/Putnam, New York.

Davies, Paul (1990). *God & the New Physics.* Penguin Books, London.

Davies, Paul (2005). *About Time: Einstein's unfinished revolution.* Simon & Schuster, New York.

Davies, Paul (2005). *The Mind of God: the Scientific Basis for a Rational World.* Simon & Schuster, New York.

Davies, Paul (2008). *The Goldilocks Enigma: Why Is the Universe Just Right for Life?* Mariner Books, New York.

Davies, Paul; Gribbin, John (2007). *The Matter Myth: dramatic discoveries that challenge our understanding of physical reality.* Simon & Schuster, New York.

Dawkins, Richard (1989). *The Selfish Gene.* Oxford University Press, Oxford.

Dawkins, Richard (2008). *The God Delusion.* Mariner Books, New York.

Greene, Brian (2003). *The Elegant Universe: superstrings, hidden dimensions, and the quest for the ultimate theory.* W. W. Norton & Company, New York.

Greene, Brian (2005). *The Fabric of the Cosmos: space, time, and the texture of reality.* Vintage Books, New York.

Haisch, Bernard (2006). *The God Theory: universes, zero-point fields, and what's behind it all.* Red Wheel/Weiser, San Francisco.

Hawking, Stephen (1998). *A Brief History of Time.* Bantam, New York.

Heindel, Max (1909). *The Rosicrucian Cosmo-Conception.* The Rosicrucian Fellowship, Oceanside CA.

Herbert, Nick (1985). *Quantum Reality: Beyond the new physics.* Anchor Books, New York.

Horgan, John (2000). *The Undiscovered Mind: how the human brain defies replication, medication, and explanation.* Touchstone, New York.

Laszlo, Ervin (2004). *Science and the Akashic Field: An Integral Theory of Everything.* Inner Traditions, Rochester, Vermont.

Laszlo, Ervin (2009). *The Akashic Experience: Science and the Cosmic Memory Field.* Inner Traditions, Rochester, Vermont.

Laurency, Henry T. (1979). *The Knowledge of Reality.* The Henry T. Laurency Publishing Foundation, Skövde, Sweden.

Laurency, Henry T. (1985). *The Philosopher's Stone.* The Henry T. Laurency Publishing Foundation, Skövde, Sweden.

Maharshi, Sri Ramana (1985). *Be As You Are: the Teachings of Sri Ramana Maharshi.* Arkana Books, London.

McTaggart, Lynne (2008). *The Field: the quest for the secret force of the universe.* HarperCollins, New York.

Merton, Thomas (1949). *Seeds of Contemplation.* Burns & Oates, London.

Moffat, John W. (2009). *Reinventing Gravity: a physicist goes beyond Einstein.* Thomas Allen Publishers, Toronto.

Pagels, Elaine (1989). *The Gnostic Gospels.* Vintage Books, New York.

Paster, Robert (2006). *New Physics and the Mind.* Self-published.

Penrose, Roger (1989). *The Emperor's New Mind.* Oxford University Press, Oxford.

Penrose, Roger (2004). *The Road to Reality: A Complete Guide to the Laws of the Universe.* Jonathan Cape, London.

Penrose, Roger (2005). *Shadows of the Mind.* Vintage, London.

Purucker, G. de (1935). *The Esoteric Tradition.* Theosophical University Press, Pasadena CA.

Radin, Dean (2006). *Entangled Minds: extrasensory experiences in a quantum reality.* Paraview, New York.

Randall, Lisa (2005). *Warped Passages: Unraveling the mysteries of the Universe's hidden dimensions.* HarperCollins, New York.

Robinson, James M. (1978). *The Nag Hammadi Library.* HarperCollins, New York.

Rosenblum, Bruce; Kuttner, Fred (2006). *Quantum Enigma: physics encounters consciousness.* Oxford University Press, New York.

Saraydarian, H. (1973). *Cosmos in Man.* Aquarian Educational Group, Sedona.

Schrödinger, Erwin (1967). *What is Life?: With Mind and Matter and Autobiographical Sketches.* Cambridge University Press, Cambridge.

Shankar, R. (1994). *Principles of Quantum Mechanics: second edition.* Springer, New York.

Sheldrake, Rupert (2009). *Morphic Resonance: The Nature of Formative Causation.* Park Street Press, Rochester.

Smolin, Lee (2001). *Three Roads to Quantum Gravity.* Basic Books, New York.

Smolin, Lee (2007). *The Trouble with Physics.* Mariner Books, New York.

Susskind, Leonard (2006). *The Cosmic Landscape: string theory and the illusion of intelligent design.* Back Bay Books, New York.

Talbot, Michael (1988). *Beyond the Quantum.* Bantam Books, New York.

Talbot, Michael (1991). *The Holographic Universe.* Harper Collins, New York.

Tarnas, Richard (1993). *The Passion of the Western Mind: Understanding the Ideas That Have Shaped Our World View.* Ballantine Books, New York.

Vallyon, Imre (1999). *The Magical Mind.* Sounding-Light Publishing, Hamilton NZ.

Vallyon, Imre (2007). *Heavens and Hells of the Mind (Volumes 1-4).* Sounding-Light Publishing, Hamilton NZ.

Walker, Evan Harris (2000). *The Physics of Consciousness.* Basic Books, New York.

Wilczek, Frank (2008). *The Lightness of Being: mass, ether, and the unification of forces.* Basic Books, New York.

Woit, Peter (2007). *Not Even Wrong: The Failure of String Theory and the Continuing Challenge to Unify the Laws of Physics.* Vintage Books, London.

Zukav, Gary (1984). *The Dancing Wu Li Masters: An Overview of the New Physics*. Bantam, New York.