Time: the Binding Mechanism of the Universe

1. Introduction

This paper defines the nature of time, its relationship to space, and the relationship between quantum and classical structures that results. The frame of reference for this discussion is as established by the Impressionist Theory of Everything (IToE).

Time represents the property of binding for the Universe. That which is bound is space and matter.[1] There are two alternative formats in which the property of time acts in this binding action. From the classical perspective, time either singularly binds space as a collection of observable structures in a common domain (this is the classical perspective) or time closes space to observation of its parts. Structures observed are then held absolutely apart as noncommon (this is the quantum-mechanical perspective).

Quantum mechanics has been so successful in describing the universe that is its tempting to reject the classical picture as out-of-date and even wrong. This is the position of most modern physicists. The reason for this is as follows. The fundamental difference between the classical and quantum-mechanical perspectives is about the role of time. On the one hand, the classical description is not symmetrical for the role of time since time flows in only one direction. On the other hand, the quantum-mechanical description is symmetrical for time since there is no distinction for its direction of flow. More accurately, two directions for the flow of time are found for the quantum mechanical description, and each cancels the other.

Simply stated, in the quantum-mechanical description of the separation of structures in space, time does not change. In other words, if we conceive that causality must move through time (from one location to another - this is limited by the speed of light in the classical realm)

[1] In the most general of terms, *matter* is space that is dimensionally twisted on itself.

then, for the quantum-mechanical description, this movement is instantaneous. Since there is no sense that time has moved forward, in the translocation across the events and structures in space, equally, there is no sense that a past has accumulated.

This is the substance of all paradoxes found in EPR-type experiments. The fact that classical space accounts for the separation of objects in time and the quantum-mechanical space does not account for separate in time means that these two descriptions are absolutely at odds (paradoxical) for the nature of cause and effect. There simply are no causes and effects in the quantum-mechanical picture since everything is simultaneous. There is no explanation, in modern physics, of this phenomenon. The reason for this is that physicists do not appreciate the complementary role of time (the mechanism of noncontainment) in both classical and quantum-mechanical descriptions.

Because quantum mechanics has been so successful in describing the universe it has lead many physicists to conclude that time is an illusion or artifact of our limited classical experience of the universe. The concept that time is an illusory artifact of our classical experience becomes the basis of concepts such as the Many Worlds Interpretation (MWI). In this theory, the events in time that we experience in the classical sense are actually transformations that occur as we move between alternative universes. In the David Deutsch's concept of the *multiverse*, the mechanism for this movement is the interference and collapse that occurs between closely related universes. Thus, those who adhere to the general concept of MWI see the role of <u>time</u> (the experience of the flow of time) replaced by the role of many universes.

David Deutsch states, "The reason why our traditional theories of time are nonsense is that they try to express these true intuitions within the framework of a false classical physics."[2] Professor Deutsch distinguishes between the intuitive appearance of the multiverse and its real

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[2] Deutsch, 1997: p. 287.

form as revealed through the nonintuitive format of quantum mechanics. Murray Gell-Mann states, “Still, classical physics is only an approximation, while quantum mechanics is, as far as we know, exactly correct.”[3] The important point is that the classical view is judged to be inaccurate and even false for what it tells us about the universe.

2. The complementary role of time in classical and quantum-mechanical structures

The deeply entrenched concept, of most physicists, that time is an artifact of our out-of-date classical picture is actually a hindrance to understanding what physics is telling us about time, space, and quantum mechanics. Our higher level concepts are only as good as the initial premises that they are built on. The concepts, conclusions, and further directions of enquiry we take are inherently tied to these premises, and if they are wrong they send us down paths that have no conclusions. The concepts of the MWI and the multiverse, although useful, are perfect examples of this.

Under the Impressionist Theory of Everything (IToE) the difference between the quantum-mechanical and classical view, for the role of time, is that time is removed from its relationship between objects (for a single domain) and rather, is used to separate these objects into (as a minimum) two paradoxically separate structures. The mechanism of paradox (through reordering of the role of time) renders the parts of the quantum-mechanical description absolutely nonresolvable in observational terms. Objects that were previously described as contiguous members of a common domain are now described as discontinuous.

When we remove time from any classical construction in this manner, we tear the fabric of the classical picture apart, and the structure we are left with is paradoxical to our classical (observational) perspective. The identities and relationships of objects are fundamentally rearranged. A very visual example to use in justification of this concept is found in the relatively

[3] Gell-Mann, 1994: p. 136.

straightforward mathematics and geometry of the half-silvered mirror experiment. The manner in which time is removed from the classical picture and given a quantum-mechanical role is illustrated perfectly.

3. The half-silvered mirror experiment

The half-silvered mirror experiment (described in more detail in Chapter 2.1, The Half-Silvered Mirror Experiment) consists of an apparatus for firing photons and a two-path structure that is created by a half-silvered mirror. The routes shown in Figure 1 are stated in ket notation (|B>) which specifies that the vectors are quantum mechanical. This ket notation is removed when the path structure is composed at the classical level (Figure 2).

These routes and their parts are defined in a two-dimensional framework that can be called a space. The photon's internal structure is closed when the space created by the apparatus is classically defined, and the photon's internal structure is open when the space created by the apparatus is quantum-mechanically defined.

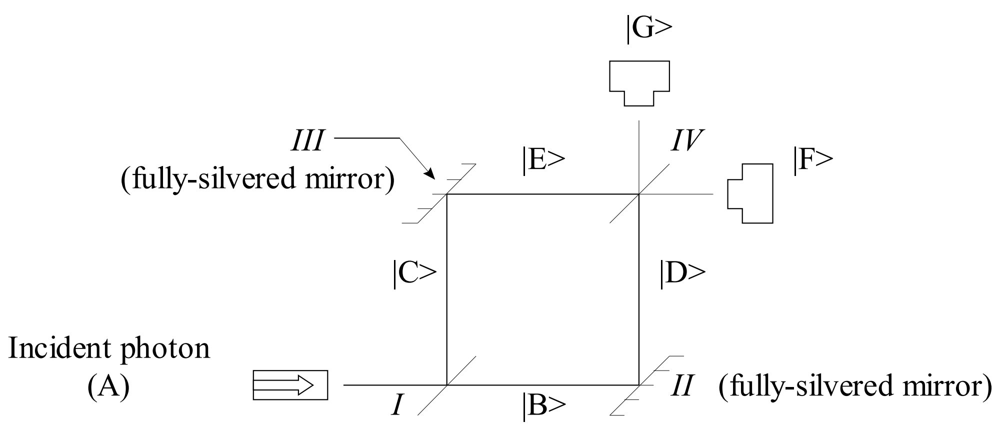

Figure 1. Illustration of the half-silvered mirror experiment: Half-silvered mirrors are found at *I* and *IV*. Fully-silvered mirrors are at *II* and *III*. In IToE, this structure is called a space within which two domains of property are housed, one quantum-mechanical, one classical. Their frameworks are joined by paradox.

3.1 Two frames of reference for the passage of a photon

There are two frames of reference for the passage of a photon across the structure in Figure 1. The first format is classical, and the second is quantum-mechanical. They illustrate how the operative property of time takes on a complementary role in each format.

3.2 The classical description

The classical description of the half-silvered mirror experiment contains two real paths that have an 'or' relationship for the passage of a single photon. These alternative structures of path are [(B) to (D)] and [(C) to (E)]. Note: Figures 2 and 3 show the same framework as in Figure 1 except that the illustrations has been rotated 45 degrees so that they are oriented vertically to these planes.

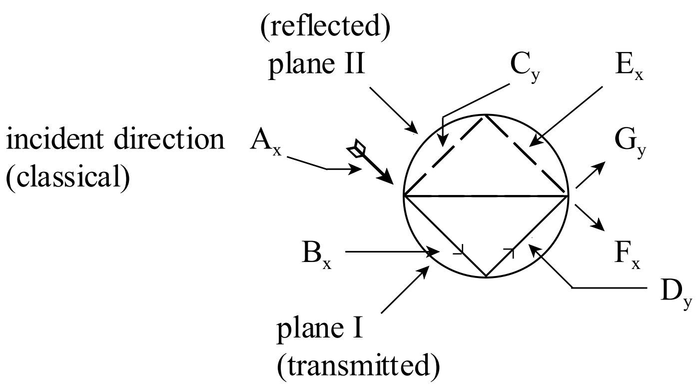

Figure 2. Classical representation. There are two potentially real paths for passage of a single photon. The solid lines indicate the one that happens to be is actually observed. This is a factor of pure chance. The dotted lines represent the other path that has equal probability of forming the path of a photon in some future event.

The first set of paths is plane I. It consists of two paths in series at 90 degrees. Exit for any photon that travels this structure is in one of two directions (F or G). The second set of paths is plane II which has the same series arrangement as plane I. Again, exit for a photon on this set of paths is one of the two directions (F or G). The relationship of planes is I '*or*' II.

3.3 The quantum-mechanical description

As indicated in Figure 1, the quantum-mechanical version for the space in Figure 1 uses the same designation of paths but is written differently because of the strange characteristic of superposition found in quantum-mechanical structures. The relationship of superposed states for the passage of a single photon is an '*and*' construction.

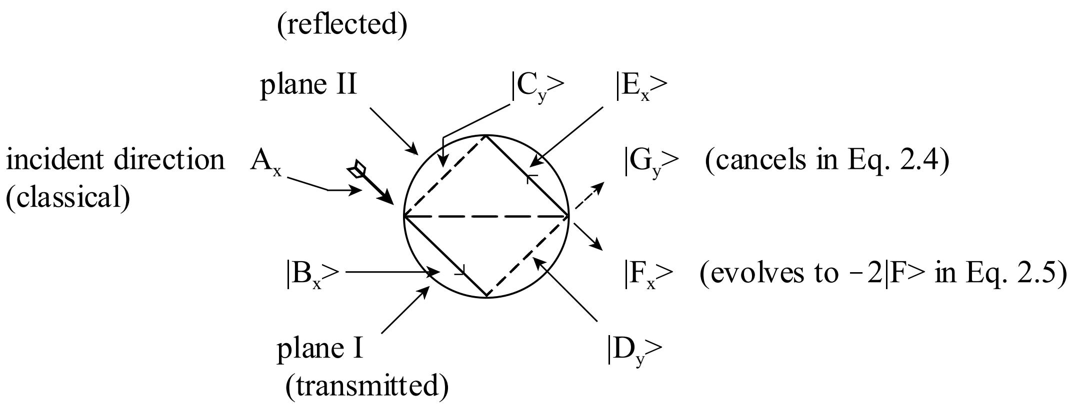

Figure 3. The Quantum-mechanical format: We now find a potential of only one path of exit for a photon that crosses this structure. Only a single (unitary) state is required to fill the space. The additive relationship of paths, previously a property of plane I or II , is now the property of state vectors across planes I and II. The state evolves as a linear superposition of the previously alternative routes.

The nonimaginary set of paths (state vectors), in Figure 3, is [|B> to −|E>] (at 180 degrees). This is a combination of planes I and II. The imaginary second set of paths is [i|C> to i|D>] (at 180 degrees), also a combination of planes I and II. Exit is not based on classical probability since it is only in the direction |F>. The direction |G> cancels, We are required to use the mathematics of quantum mechanics, and classical probability does not give the correct answer for what happens. The result of this calculation is

$$[\; i\,(|G\rangle - |G\rangle) + (-2|F\rangle)\;] = -2|F\rangle \text{ (see below).} \qquad (3.1)$$

The fact that the two structures for the same space (classical and subclassical or quantum-mechanical) have inconsistent properties leads to the unavoidable conclusion that the spaces are not the same space, even though they are contained in exactly the same domain. This is also the salient feature of the Russell paradox. The situation is made more perplexing because the mechanism that causes one or the other description to prevail is to simply observe or not observe the interior of the common domain displayed in Figure 1.

4. Do dominance

In no other situation does the act of observation have such a destructive effect on the rationality of any process. Under the Impressionist Theory of Everything (IToE), a new mechanism is described that is responsible for the rationally unaccountable relationship between the quantum-mechanical and classical states. This mechanism is the conservation of potential across fundamentally different dimensional constructions.

In brief description of this concept, the classical alternatives of route must be hidden at the subclassical level so that the dimensional complexity of the two spaces (subclassical and classical is respected). If we were to find classical alternative displayed at the subclassical level or quantum-mechanical nonalternative displayed at the classical level then the level of degree of freedom at each of these levels of dimension would be violated. This concept is explained fully in Chapter 1.5, The Cross-Dimensional Development of Angularity.

At each level of dimension, unitary (in the quantum-mechanical state and probabilistic (in the classical state), these structures of possibility protect the appropriate level of dominance for conclusion. *Dominance for conclusion* is determined by two factors that are whether we can observe a photon on an individual path within the structure and whether we observe one or two possible routes of exit.

5. The classical description

The classical format for construction of the paths in the half-silvered mirror experiment is straightforward. It is rational and intuitive because it is what we expect in our classical experience. For example, the plane consisting of paths [(B) + (D)] is one of two rational routes across the space of Figure 1. This series of paths passes across the full mirror at *II*. The other rationally composed route is (C) + (E) which passes across the full mirror at *III*. If observation occurs within this space of paths, the space is found to contain two probabilistic alternatives of route for a single photon; the photon is always found on one of them. Little discussion is required to validate this assertion since it is obvious from our everyday experience of similar situations. The rationalism for the classical path across mirror *II* is represented as

$$B_x + D_y \quad \rightarrow \quad F_x \text{ or } G_y \tag{2.1}$$

Subscripts x and y refer to the orthogonal directions in the space relative to incident A.

The plane for passage across mirror *II* is a additive series of directions. The identities of the paths are established by their values, which are each understood to be (1), and accordingly, each part of the total route is a whole and instantaneous location for evolution of the action that crosses the space.

6. The quantum mechanical description

When the above space is not observed, a quantum mechanical description applies. By not observing, the observer has not forced raising of the state to the classical level in which the observer has membership. As discussed above and in Section 1 of this web site, under IToE, the quantum mechanical or subclassical space is fundamentally simpler for its complete composition.

The quantum-mechanical structure in Figure 2 does not represent just one space, but rather two. There are two infinities for potential path displayed, one nonimaginary and one imaginary. Neither the nonimaginary nor the imaginary structures of paths are observable. Each is missing some element that is required for the phenomenon of observation and that which is missing in each is complementary to the other set of paths. It is the dimensional nature of the space in Figure 1 that determines whether there are two rational paths in a singular space (classical) or one nonimaginary path (albeit fractured because its elements are found at 180 degrees). For discussion of the nature of paradox and complementarity across mathematical structures of the two-dimensional plane, see Chapter 1.3, Two Mathematical Spaces, One Roof: The Local and Nonlocal Structures of the Unit Circle.

7. The mathematical description of the subclassical space

The unitary evolution of the quantum mechanical state is indicated in Equations (2.1) to (2.5) using ket notation. When the photon is left undisturbed (not observed), it passes through the domain according to the mathematical representation in Equations (2.1) to (2.5). We see that in the nonimaginary portion of the structure direction is both forward (+ for |B>) and backward (− for |E>). This direction is of time, and because of the opposite signs we cannot state that time flows in the classical sense . Note: $i \times i = -1$.

$$\text{If } a > 0, \quad \sqrt{-a} = i\sqrt{a}; \quad i^2 = -1 \qquad (7.1)$$

$$\begin{aligned} A &\rightarrow |B\rangle + i|C\rangle && (7.1) \\ |B\rangle + i|C\rangle &\rightarrow i|D\rangle + i\,i\,|E\rangle && (7.2) \\ i|D\rangle - |E\rangle &\rightarrow [\ i|G\rangle - |F\rangle] + [-i|G\rangle - |F\rangle] && (7.3) \\ &= (-2|F\rangle) + i(|G\rangle - |G\rangle) && (7.4) \\ &= -2|F\rangle && (7.5) \end{aligned}$$

8. Property is reversed across the parts by the role of time

The domain of the half-silvered mirror experiment contains, on one hand, a unitary state (all its parts contained by a single event) and on the other hand, a dualistic state (all its parts are not singularly contained by a single event). The terms that apply are containment and noncontainment. The first is quantum-mechanical and the second is classical. The structure is exactly represented in linguistic terms by the Russell set which is stated as *the set of all sets that* *are not members of themselves* (see Chapter 1.2, The Paradoxical Reversal of Property in Three Theoretic Structures). The mechanism across the two constructions is the reversal of property for path.

There has been a reordering of what is continuous between the classical and quantum mechanical versions of the overall space. Continuous path is composed in series in the classical version, and it is composed in parallel in the quantum mechanical version. The paths |B> to |E> (at 180 degrees) are continuous (although not so in the classical sense) because of the overriding consideration that any set of paths with $\sqrt{-1}$ attached to its members cannot be called real or continuous. The ortho structure of paths [|B> to −|E>] and [i|C> to i|D>]is 180 degrees. These two structures (one nonimaginary and one imaginary) are dimensionally simpler spaces!

The important point is that the quantum-mechanical construction was formed by removing time from the relationship of objects in the classical picture. Where does time go? Time takes on the new role of paradoxically separating the path structures [|B> + (−|E>)] and *i*[|C> + |D>]. To explain more fully, we need to go back to the strange property of time that it accumulates in an imaginary manner, while distance accumulates as real.

9. The accumulation of domain by containment and noncontainment

The simplest example of the dynamic accumulation of a domain as *contained* is found in an apple falling from a tree under gravitational force. The apple accumulates distance in its path. By contrast for time, we have no sense that anything has begun to form a contiguously linear path - we sense only the present. The difference is that distance is accumulating by the format of containment, and time is accumulating by the format of noncontainment. In other words as each part of time accumulates, the format for generation of this property is that the parts are not contained to each other.

We now extend this concept to what is observed in the half-silvered mirror experiment.

The same property of non-containment identifies the relationship between the nonimaginary and imaginary halves of the quantum mechanical description in Figures 1 and 3.

Specifically, the removal of time, as establishing the format of classical relationship between objects in a common space, allows rearrangement of the sequence of paths. The result is a linear superposition of paths (the quantum mechanical description). What we refer to as *time* now forms the relationship between the two domains of path: [|B> + (−|E>)] and *i*[|C> + |D>]. The property of time is openly responsible for their mutually imaginary (discontinuous) relationship. We should take the term *imaginary* in its literal sense when we refer to (*i*) as a property.

10. Conclusion

The property called *time* in classical structures more generally represents the factor of *noncontainment*. The role of noncontainment (time) in classical and quantum mechanical constructions is complementary and based on the paradoxical reversal of some defining property within the domain under consideration. In the case of the half-silvered mirror experiment, this is the relationship of paths in parallel and series. In this experiment, time's relationship to distance is detached from the classical format, and the result is that the fundamental nature of space takes on an alternative structure.

The conclusion that quantum mechanical formalism is more fundamental than classical formalism is false because it does not recognize the equal role for the property of noncontainment (time) in each description, and the true dualism and complementarity displayed by the relationship of the classical and quantum-mechanical descriptions. These two formats are absolutely equivalent, alternative, and paradoxical constructions, and consequently, neither description is a complete picture of how Nature is composed as an absolute dualism.

The above example of the half-silvered mirror experiment requires only two dimensions.

However, if the relationship of the quantum-mechanical and classical formalisms is to be consistent for collapse of the wavefunction, then this concept must equally apply to more complex structures.

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1. Gell-Mann, Murray. 1994. The Quark and the Jaguar, New York: W. H. Freedman and Company.

