The Quantum Essence of Distance-Time Theory

(A quantum time and space manifold wherein quantum weirdness is intrinsic)

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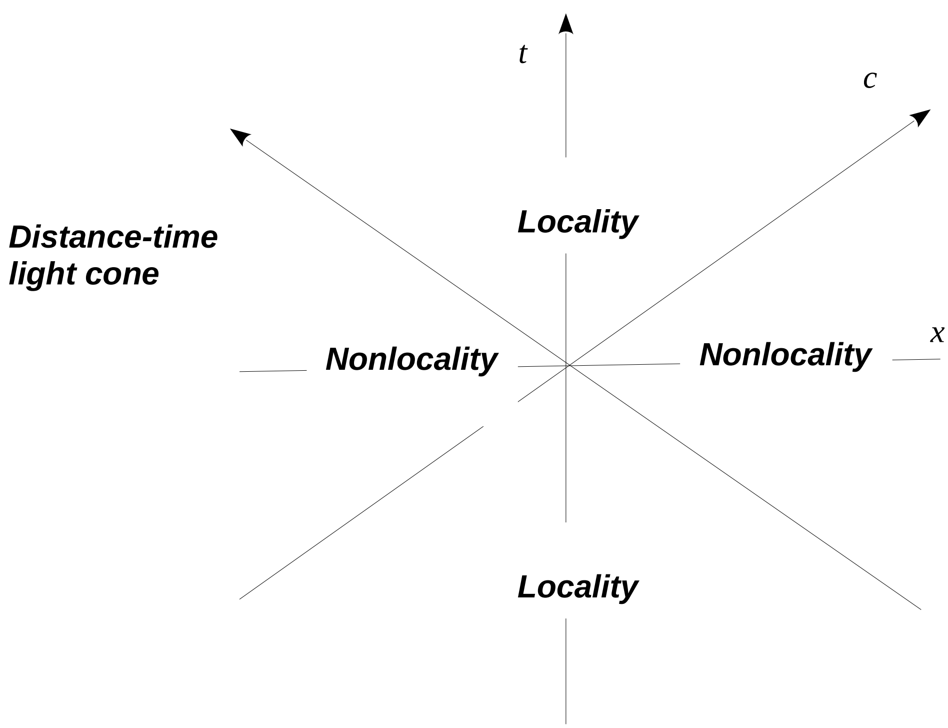
ABSTRACT
Distance-time theory is intrinsically a quantum time and space structure because it has both local and nonlocal regions. Hence the quanta is a probabilistic interface between these regions. I use a probabilistic wave distribution and create a rule: *events within the waviness obey a nonlocality rule, and measured events external to the waviness obey locality rules.* Using this rule, I discuss quantum nonlocal behavior within a distance-time structure. This discussion includes quantum tunneling, entanglement, and time travel.



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1) Introduction

I have been pondering the quantum nature of a distance-time manifold. I decided to write probably my last physics paper about these thoughts. In distance-time theory, distance-time has a speed c. Therefore reference frames with speeds faster than or equal to c have no time or space between coordinates. This results in a nonlocality realm. Speeds that are slower than c have reference frames with time and space between coordinates. However, this leads to a problem. Allow me to explain. If an object was sitting in a classical time and space manifold, it would be in every reference frame that is possible within that manifold. The same should be true of any type of manifold, including a distance-time manifold. However this creates a conundrum for distance-time theory, because in that manifold an object would be in the realm of both locality and nonlocality. The solution to this leads to a time and space structure that agrees with quantum theory.

The reason that quantum behavior is intrinsic to the distance-time construct is that a quanta must reside within both a local and nonlocal realm while placed in the manifold of distance-time. For a quanta to do this, it must behave as an intermediary between these two realms. I describe the nonlocality zone at $speeds \geqslant c$. Furthermore, there is no difference among any coordinate locations in this realm. Therefore a quanta sitting in nonlocality is at all locations and also located at one location in the realm of locality at $speeds < c$. Therefore the quanta must go from all locations to one and does so probabilistically. Naturally, I use a wave for the probability distribution.

I now create a basic rule for the quantum waviness. *Within the waviness of the quanta, events obey nonlocality rules, and measured or external to the waviness, events obey locality* *rules.* This basic rule for quantum waviness predicts that quantum tunneling, entanglement, and time travel obey nonlocality rules, while effectively the rest of physics obeys locality rules.

I start with the intrinsic probabilistic nature of distance-time, which led to the very creation of time and space. Then, I discuss the aforementioned internal and external waviness rule. I felt that creating a light cone for distance-time theory was pertinent because it gives a visual understanding of a distance-time manifold. As such, I describe it in the next section. This is followed by a discussion of tunneling, entanglement, and time travel speeds. The following two chapters delineate the reason quantum waves act like particles when measured and explain the collapse, not of the wave function, but the loss of medium for the waviness. Next, I sum up the zones of locality, probability, and nonlocality along with their respective events. I conclude the paper with some basics of distance-time geometry and its holistic cosmic simplicity.

The prerequisites for this paper are quantum and special relativity theories. In addition, distance-time theory should be read in conjunction with or prior to this paper.

2) Quantum probability is intrinsic to a distance-time construct

I previously wrote a paper entitled “The Theory of Distance-Time.” In this paper, I was able to create a time and space theory wherein distance was equivalent to a period of time multiplied by the speed of light in a vacuum c. I used the scalar equation $(D=cT)$ or vector equation $(\vec{D}=\vec{c}\,T)$. Time is always a scalar. There are no three-dimensions of time.

The theory of distance-time worked sufficiently that I was able to derive both classical and special relativity space and time results. Nonetheless, there is a unique characteristic found only in distance-time theory. This characteristic is that for reference frames with $speeds \geq c$, distance-time $(D/T = c)$ has not yet occurred. Therefore there is no distance or time between distinct coordinate locations. In my previous paper, I called this realm, which occurs at $speeds \geq c$, nothingness. I here give it a new name of nonlocality. This is where there is no difference between distinct coordinates. In addition for the realm where $speeds < c$, I rename it the locality realm. (Previously I called it somethingness.) This is where the magnitude of difference (distance-time) exists between distinct coordinates.

In my first version of distance-time theory, all I had was the two realms of locality and nonlocality. This was a classical approach to distance-time theory and was ineffective. The reason for this is best illustrated by the first serious criticism I received, as I will explain. If an object was located in a distance-time manifold, it would have to be located in the realms of both locality and nonlocality. An object residing in locality is located at a single spot, whereas this same object, when also residing in nonlocality, is located at every spot within that realm. This seems contradictory because it *is* contradictory. An object cannot exist at one spot and everywhere at once. This classical approach to a distance-time theory was inadequate. Instead I needed an object *not* to act as a classical object behaves in classical theories of time and space. This is because, in classical theories, the object simply exists at only one spot within the realm of locality. Instead, in distance-time theory, I needed the object to be an intermediary object that can be in both the realms of locality and nonlocality without a contradiction.

For an object to be an intermediary between locality and nonlocality, it must go from being located at all locations within the nonlocality zone to one location in the locality zone. This can only be achieved through probability. Within locality an object has a certain location, and within nonlocality an object is located everywhere. I now create another realm, and it is probabilistic. Needless to say, all objects within a distance-time manifold must have a probabilistic position in both time and space. I will discuss this in greater depth later.

As I have described, distance-time theory cannot be a classical theory. Instead it must be a quantum theory of time and space. If the universe time and space model is distance-time, then the universe has to be a quantum universe because there is no classical distance-time theory.

In my final version of distance-time theory that I published to the Internet, I mentioned probability in the latter part of the paper in an attempt to rectify the problem brought about by locality and nonlocality being present in a single manifold. However I realized I needed to go much further, which led me to this paper.

3) The creation of time and space

All objects within a distance-time manifold need to be represented by a wave representing probabilistic location. This is obviously not a revolutionary concept for anyone familiar with elementary quantum theory. However what is different here is that objects have to be probabilistic so that they can reside in a distance-time manifold with its two realms. Objects (probability waves) act as the probability realm, which is the interface between the local and nonlocal realms, and this probability realm takes the universe from nonlocality to locality. Another way of looking at it is that it is necessary to use waves (particles), such as eventons and atoms, so that their probability characteristic can go from no time and space to space and time. In other words, the waves of eventons and all other particles essentially create time and space (locality) out of no time and space (nonlocality). Without all the objects in time and space (Earth, Moon, atoms, eventons, etc.), there could be no time and space.

Because all particles are waving within the probability zone, they act as an intermediary between locality and nonlocality. Like all go-betweens, all quanta must have dual characteristics of locality and nonlocality. In the same way the color purple has pixels of blue and red but is neither entirely red nor blue, probability can only exist if both locality and nonlocality exist and both characteristics are found within the probability realm of the quanta. In distance-time theory, I use the concept of an ocean of eventons in the cosmos to create time and space throughout the cosmos [1]. This obviates the need to have a known particle everywhere to create time and space.

Allow me to explain the discussion so far a little differently. In nonlocality, the particle is located at every location with an equal probability to being found everywhere there. In transit going from nonlocality to locality, a particle becomes more likely to be found in one location as opposed to another. Hence proto-distance-time exists in transit going from the nonlocal realm to the local realm, and it has partial traits of nonlocality and locality. It obeys the nonlocal rule for time and space and represents a difference between the probable locations of detecting a particle's location. Finally, the particle's location is detected by another particle traversing distance-time at a finite speed, and its location at a specific spot emerges within locality. All other possibilities outside of this spot disappear.

Proto-distance-time seems similar to the traditional concept of a distance. It occurs instantaneously like a traditional distance but does not give an exact location like distance. Instead it is wavy and only gives the probabilistic distribution of a particles location. This probable distribution still allows the particle via its waviness to be located everywhere at superluminal speeds similar to nonlocality. The average of the superluminal speeds is the instantaneous speed. This means that the wavelength of a quanta wave happens instantaneously. However when it is measured and localized, the distance-time in locality is not wavy but deterministic. Neither is it instantaneous but instead has a finite speed c.

4) The waviness' internal and external events rule

If an object is represented by a wave that is an interface between the local and nonlocal arenas, then different aspects of the wave must be in both these arenas. The two different parts of the wave are the waviness in a medium (internal) and the measurableness of the waviness (external). Because an intermediary must reside in both arenas that it goes between, the wave cannot solely reside in just one arena. Even a wave such as an eventon, which is not directly measurable, still produces distance-time, which is measurable externally to the eventon. The external ability to measure a wave is still part of a wave. Furthermore, the wave behavior found internally to a wave is a part of the wave. Therefore the wave necessarily straddles both locality and nonlocality.

There are two basic types of events in the distance-time model. Events that are internal to the waviness, and events that are measured. I make the assumption that an event exterior to the waviness is a measured or detected event, and an event interior to the waviness is not a measured or detected event. I now postulate a rule for the two different types of events. *The events that occur without measurement obey the time and space rule of nonlocality. The events that are measured exist outside the waviness and obey the time and space rule of locality.* Examples of events happening within the waviness are quantum entanglement, wave interference, quantum tunneling, and quantum time travel. Examples of measured events happening externally to the waviness are, essentially, everything else. Specific examples are balls bouncing off each other, cars crashing, and objects being measured. Gravitation's and other forces' interactions with objects are events that exist are measured externally to a particle's waviness.

5) Distance-time light cone

The following figures relate to the light cone. They are intended to provide a visual of locality and nonlocality within a distance-time manifold. This visual includes rulers measuring at speed c, as well as the location where different aspects of the waviness reside. The idea for the distance-time light cone is derived from special relativity's light cone. From Figures 1 or 2, one can easily discern that no speeds faster than speed c can occur in quadrants 1 or 3. In fact, if any object were to travel faster than light in a vacuum, it would travel faster than measured distance-time $(D/T = c)$ in any reference frame in those quadrants. Therefore objects with superluminal speed do not cross time and space in the realm of locality.

In actuality, the distance-time we experience everyday is measured distance-time and occurs at speed c. That is the reason the ruler measuring takes place at speed c. The proto-distance-time I create is for the purpose of creating a probable locality between nonlocality and locality. This idea allows for a probabilistic concept that gives an instantaneous proto-location for all objects. Probable locality spans non-locality and locality by starting in nonlocality and finishing in locality. It is only through measuring can an actual time and space location be determined (localized) out of probable locality. Because the quantum hypothetical medium has a propagation speed c, distance-time is measured at that speed.

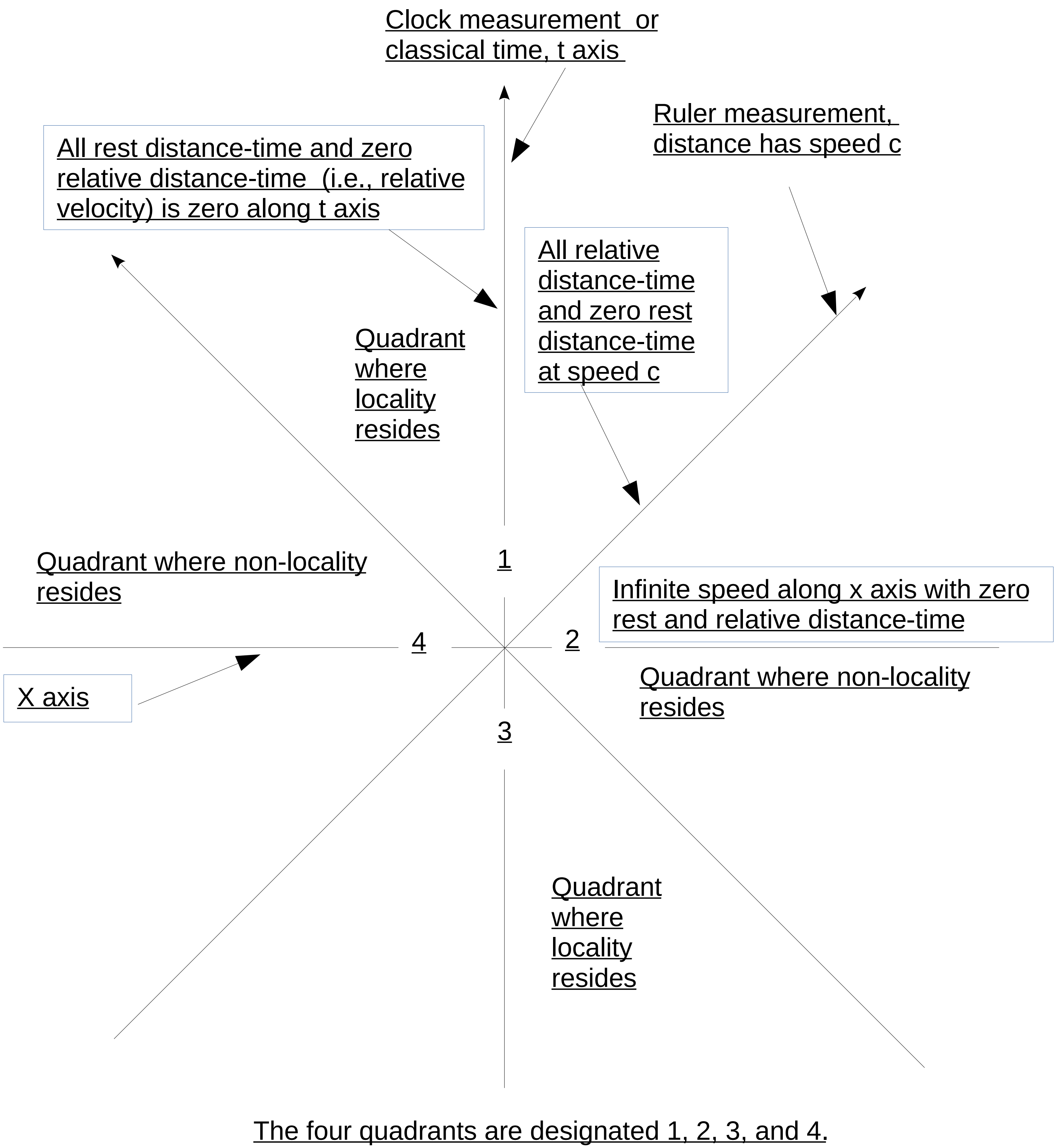
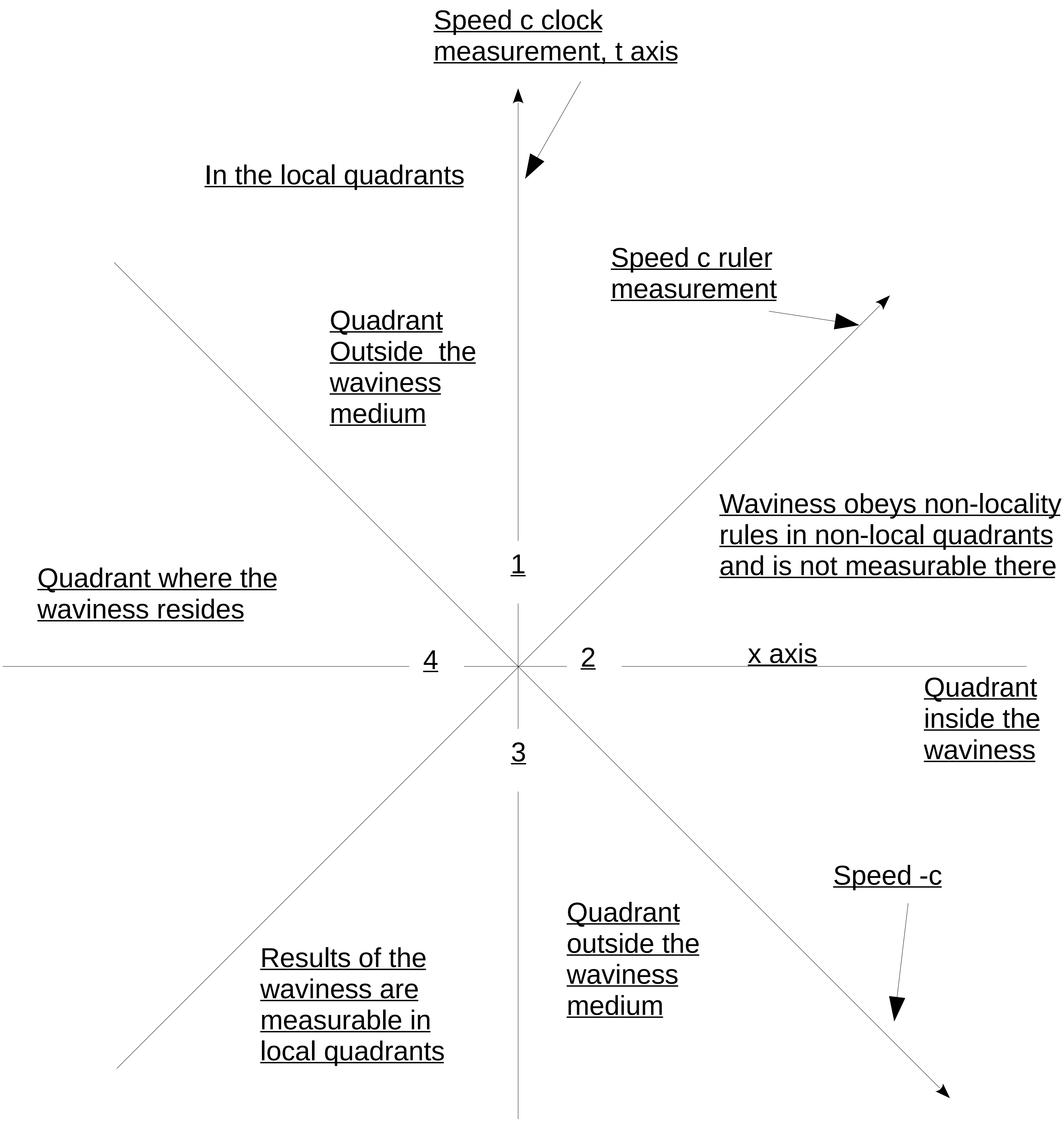


Figure 1. Distance-time light cone.

Figure 1. In figure 1 there are four quadrants. Quadrants 1 and 3 are the realms of locality. The frames of reference in these quadrants are slower than speed c. This allows distance-time at speed c to travel throughout all frames within these quadrants, which are realms of locality. Quadrants 2 and 4 are the realms of nonlocality because they occur at speeds equal to or faster than light in a vacuum. Therefore distance-time is too slow to travel throughout these frames of reference in the nonlocal realms. All measurements or experiences of time and space happen within quadrants 1 and 3. Usually most measurements of distance that occur along a ruler would happen at the speed of light. This is shown in both figures.

In quadrants 2 and 4, no rest or relative distance-time can happen. (Relative distance-time is found in a relative velocity or speed.) If any set of events happens in quadrants 2 and 4 relative to the observer, they actually do not happen across distance-time. Instead these events skip across space and time relative to observers in the local realm. These would skip from one coordinate to another because there is no distance-time between coordinates within the nonlocal realm. The phrase rest speed (distance-time) is covered in distance-time theory [1]. Rest distance-time is measured by a clock. Relative distance-time is measured by a ruler.

In the distance-time light cone, there is an axis for the clock measurement. This should not be understood as there being a separate axis for time. This is because in distance-time theory, a clock measures only the scalar magnitude of distance-time that has occurred within the given three dimensions. This makes this kind of measurement a scalar. Furthermore time is represented by a scalar coordinate—not a separate axis in a distance-time manifold. Nonetheless, I can place time on a separate axis, and it can still produce mathematically the same results.



The four quadrants are designated 1, 2, 3, and 4.

Figure 2. Inside and outside the waviness.

Figure 2. The observer can only measure with a ruler as fast as speed c. Quadrants 1 and 3 are external to the waviness. At a finite speed c, the observer can only detect the waviness within said quadrants. Although the waviness actually exists in all quadrants, the rules within the wavy obey the rules of nonlocation found within quadrants 2 and 4. Also in quadrants 2 and 4, proto-distance-time resides. In other words, the observer cannot detect nonlocality but only measure externally to the probabilistic waviness in quadrants 1 and 3. The probability spans from nonlocality in quadrants 2 and 4 to a specific spot in quadrants 1 and 3. If waves did not span across both realms of nonlocality and locality, they could not be externally measured in the realm of locality. Although this waviness is probabilistic, it has nonlocal behavior within the waviness and local behavior when measured externally to the waviness.

Because the quantum hypothetical medium has a wave propagation speed c, distance-time is measured at that speed. Before any measurements and external to the waviness there is a probability realm with a proto-distance-time. This does happen instantaneously giving a probable locality to all objects before they can be measured at a finite speed. Remember I stated earlier that I make the assumption that an event exterior to the waviness is a measured or detected event, and an event interior to the waviness is not a measured or detected event.

6) The speed of quantum tunneling, entanglement, and time travel

I must now discuss how a quanta travels via nonlocality. It is analogous to moving from one part of a point in classical time and space to another part of the same point. Yet there is no difference among parts of a classical point because it is infinitesimal, and this is the same for nonlocality. There is no difference between any coordinates within it. Nonetheless, according to the distance-time light cone, nonlocality resides between speeds c and $-c$, whereas the classical point only resides within an instantaneous speed. The distance-time light cone is a reference frame for an observer. Therefore what happens for one observer is different for another. The difference between reference frames is found in my distance-time theory or special relativity [1-6].

I only assume that relative to an observer making a measurement, the quanta travels according to the average speed traveled between c and $-c$, which is instantaneous relative to any detector in any reference frame. Perhaps traveling via nonlocality is more complex or even different than that assumption. In other words, it could be that traveling via nonlocality does not require the average speed. When I refer to the term "speed," I am saying that a quanta skips from one coordinate to another via nonlocality relative to an observer within locality. And this observer would measure this skipping from one coordinate to another as having a speed.

If the waviness always obeys the nonlocal rules within the probable zone, then the speed of events within waviness should also occur instantaneously. However, the average speed of the waviness can be instantaneous relative to any reference frame within locality. Therefore, any events that happens within the waviness can be instantaneous relative to any reference frame. Nevertheless, once measured, all events must obey the rules of locality, which means events must solidify (i.e., localize) and be at a specific location. Furthermore they must obey all the rules within locality, including Einstein's rule of special relativity. In relativity, an instantaneous set of events changes, going from a reference frame with speed v to another reference frame of speed 0. For instance, Einstein described that the simultaneity of two events in one reference frame is not simultaneous in another [2-6]. Hence according to special relativity, what is instantaneous in one reference frame is not in another. However Einstein was referring to events in locality—not to events within nonlocality. Special relativity and distance-time theory are mathematically identical with predictions for all events external to the waviness [1-6]. Nonetheless this is not the case for events that take place within waviness. In the waviness, all possibilities occur. Only when measured does it localize around one choice, which I choose to be the average possibility.

Think of how distance is treated within special relativity theory. The distance always occurs instantaneously relative to any observer. However the distance may contract and have a different length relative to different observers [2-6]. This is similar to how proto-distance-time and proto-wavelengths should be treated. In distance-time theory, proto-wavelengths exist between speeds c and $-c$. However the average speed of a proto-wavelength is instantaneous in all reference frames. These wavelengths can potentially be measured. They represent probabilistic proto-distance-time until measured. Anything that is part of the wave is within the waviness. It is when measuring or detecting occurs, that external events happen outside of the waviness. Is there anything about the wave that does change in going from one reference frame to another frame with a different speed? The wavelength and frequency of the same wave will be different as measured within locality by an observer in different frames of reference. The proto-wavelength and proto-frequency would obey special relativistic length contraction and time dilation when measured. Nonetheless, the rule of nonlocality applies to all distance and time within the waviness. Hence within the same wave, there is no difference for all time or distance among any wavy events.

Examples of the events within the waviness of a quanta are the quantum phenomena of quantum entanglement, quantum tunneling, and quantum time travel. Because the events within these phenomena occur within the waviness, they should occur instantaneously. Briefly, if two quanta are entangled and if one was measured to have a particular direction of spin, then its entangled partner would instantaneously have the reverse spin even if it was at the other side of the known universe [7]. This would occur nonlocally for both quantum theory and distance-time theory but not special relativity [2-7]. Because quantum tunneling occurs strictly within the waviness, this should also occur instantaneously relative to any reference frame [8]. An example of nonlocal quantum time travel is found in the two-slit experiment. A quanta (electron) passes through two slits. After passing through, it then gets measured as passing through one slit. Before measuring the results of events, these events of the path that a quanta travel are strictly within the waviness. Because the wave is only measured as going through one slit, the quanta time travels backward in time via nonlocality and then takes only the path that leads to the single slit where it was measured passing through. This occurs instantaneously according to distance-time theory and quantum theory but not special relativity [2-6, 9]. There is no time travel in special relativity. When I say it occurs instantaneously relative to the observer, I mean that the results can be measured and the observer can determine that these wavy phenomena occurred instantaneously. However, the observer in a particular reference frame determines it to be infinitely fast, then the observer in another reference frame would determine it to be at a different superluminal speed because there is a difference of simultaneity of events among reference frames according to special relativity and distance-time theory [1-6]. I do not know what designates which reference frame is where instantaneous speed occurs and which has other superluminal speeds measured that are not instantaneous. This may be discovered empirically.

7) The illusion of a particle

What is the illusion of a particle in the traditional interpretation of quantum theory? I am referring to the particle-wave duality concept found in the Copenhagen interpretation of quantum theory [10-14]. The idea is that while detecting the location of a quanta, the wave collapsing to a particle is another one of nature's illusions. As I have delineated earlier, the wave never disappears when measured. Unlike quantum theory's particle-wave duality, distance-time theory and my theory of quantum wave sources states that the detection of a particle's location is like placing a barrier with a slit in a traditional medium [1, 15]. I refer to this as a measurement barrier in quantum theory. In any traditional medium in which the waves are waving, a barrier with a slit can be placed in the medium. The only place the wave can pass through is the slit. For instance, placing a block with a slit in a tub of water allows the water waves to ripple through the slit but not through the barrier. Similarly, measuring the location of a quanta causes a measurement barrier to occur, which leads to the illusion of a wave collapse. In actuality, a quanta cannot wave where the barrier is placed because the medium of the quanta is replaced by the barrier. Therefore the quanta has ceased waving within the region where the barrier lies. The wave has not collapsed, but the medium for the quantum wave has been destroyed. Now the quanta can only wave within the slit of the barrier. In this case, for the quanta, it is the region wherein the wave was located in which the quanta is still waving. Outside of this region is where the measurement barrier occurred. Hence the wave never collapses when measured, but the quanta's medium is destroyed and replaced by a measurement barrier. Now the entirety of the wave only exists within the slit or region wherein the wave was detected.

The compacting of the waviness in the small region of the slit when measured puts all the waves' energy in a small location. In quantum theory this measurement barrier can be one, two, or three-dimensional. When a photon is detected to land on a wall, it is a single electron that absorbs a single photon. That photon is absorbed totally by the electron. As a result, the photon's location has been determined to exist within the three-dimensional sphere of the electron. This condition would result in a three-dimensional measurement barrier, and all of the quanta's waviness with all of its momentum and energy would now only be located within the three-dimensional region of the electron. In other words this electron's region, where the photon has been detected to reside, now acts like a three-dimensional slit to a three-dimensional measurement barrier which is the measured locality outside from where the electron resides. Therefore the photon affects the absorbing electron in such a manner that all of the photon's momentum and energy is compacted in the location of that electron. This is the result of a photon's impacting an electron-wave. This creates the illusion of the quanta turning into a particle when detected. However, the quanta never becomes a particle and stops being a wave, even when measured or detected in any fashion. It simply waves in a confined region similar to a particle residing in a discrete region. This region can be one, two, or three-dimensional. See my theory of quantum wave sources for the wave source interpretation of quantum theory [15].

8) Measurement

The medium in which a wave propagates is the probable realm. This probable realm is the intermediary between the nonlocal and local realms. This local realm is the only place where distance-time can be defined. In other words, an observer can only measure within the local realm—not the probable or nonlocal realm. Hence, inside the realm of locality, an observer only directly interacts with objects and their respective events. In the probability realm, the observer can only indirectly interact with it by measuring it. In other words, the observer can detect results that come from probability. However, the observer cannot measure inside it. It will disappear or collapse if measured. On the other hand, the observer has no direct or indirect encounter with the realm of nonlocality. To sum up, the totality of an observer's experience comes from the local or probable realms. Then why the need for the nonlocality zone? Said zone comes from the fact that distance-time has a finite speed. Therefore there is no distance-time defined between coordinate locations at speeds faster than speed c. This reality gives rise to the need for the probability zone between locality and nonlocality.

Because all distance-time is defined by any particle's motion, then all the time and space within a distance-time manifold must obey Heisenberg's uncertainty principle. Said principle is given by Equations 1 and 2:

$$\Delta x \Delta p > h/2\pi \quad , \tag{1}$$

$$\Delta E \Delta t > h/2\pi \quad . \tag{2}$$

Because Heisenberg's uncertainty principle limits an observer's ability to measure small intervals, distance-time theory is also limited in terms of measuring in the small interval. Of coarse, this limit is imposed by Heisenberg's uncertainty principle, which is discussed in most elementary quantum mechanics texts [10-14].

The next question is what exists at intervals of time or distance smaller than an observer can measure. This is the probable zone. The quantum medium is the probable locality zone, while the locality zone is not the medium for the quanta wave. This means that when a detector measures a quanta's location, the act of measuring works like a barrier because locality replaces probable locality. Hence the quanta can only wave in the interval too small for the detector to measure. As a result, when a quanta's location is detected, it only waves in a small slit-like region. It does not wave outside of this slit. It can only wave in the medium of probable locality within the slit. For anything larger than this slit, there is a distance that is measured and creates a barrier of no probability. Hence the wave ceases to exist if it becomes wider than the slit.

I will now describe how to perceive a distance-time manifold filled with probabilistic objects (particles). If I were to perceive it as a probabilistic proto-distance-time, then I could imagine objects located infinitely fast apart from each other. Of course, they would be separated by the probability of where an object could be located when measured, but not by time or space. Is this contradictory? Think of waves on a drum medium that are apart instantaneously from each other because they are on a medium that classically exists instantaneously. Nonetheless the waves have a finite speed traveling across the drum. Similarly, these quanta waves exist relative to other waves' location in the superluminal probability realm (quantum medium). Nonetheless, the propagation speed across the quantum medium is speed c. It appears that I am giving these objects (particles) instantaneous space to be separated by it. This is not true because the probability realm is going from nonlocality to locality. Hence the waviness medium obeys the laws of nonlocality. For matter, the probability realm is superluminal because observers measure in the locality realm at speed c. These waves actually reside in probability realm with a proto-time and proto-space, which partially has nonlocality traits because locations in the waviness happens everywhere instantaneously. On the other hand, there is an uneven distribution of probabilistic outcomes for locations. This creates a difference when externally measured so an observer can measure across it at speed c. Probabilistic proto-space and proto-time is not the same as time and space that is measurable. It is an intermediary state where time and space is being formed or something similar. Hence this probability realm allows the waviness to obey nonlocality by instantaneously being apart as waves because they can be measured apart in the locality realm at speed c by an observer. In other words, matter, time, and space are not solidified until measured. Until they are measured, they are uncertain with instantaneous probabilistic locations. To sum up, all objects are separated by an instantaneous probabilistic proto-distance-time that is not as yet measured distance-time. The measuring of distance-time occurs at speed c within locality.

9) Summary of zones and events

In a distance-time manifold, there are three zones and two types of events. The zones are locality, nonlocality, and probable locality. The events are either internal or external to the waviness. The locality zone only has events happen within it that are measured and external to the waviness. The observer detects neither the nonlocality zone nor any events within it. Within the probable locality zone are the events that happen within the waviness. The observer can measure externally to waviness but only in the locality zone. However until a measurement of location happens, the events are probable. In this realm of probability, wavy events such as interference, tunneling, entanglement, and even time travel occur inside the waviness. Only the results of these types of events are detected—not the events themselves which always obey nonlocality rules.

10) Distance-time geometry basics

In distance-time geometry, a line cannot exist strictly only across distance but must also across time because $D = cT$. In fact any line, straight or curved, has to have a speed associated with it because no line can traverse any distance without traversing time. The speed associated with the line may vary between $0 < speed\ with\ line \leqslant c$. Another way to approach it is to simply assume that the only speed present in the geometry is speed c. All other speeds can be obtained with fractions of c. In other words, I can draw a line designating it to be a fraction of distance-time occurring at a slower rate and thereby with a speed less than c by that same fractional amount. This slower line represents an object of matter with a slower speed in a distance-time manifold. All speeds slower than speed c in distance-time theory are fractions of speed c [1].

Because I am assuming that all speeds associated with a line are speed c and not a slower velocity, then all lines and all other geometric structures made from lines will also have a speed c associated with them. This means that an area has lines in it, and these lines can go in any direction within the area, and each line has a speed c associated with it. I refer to this as the speed of the area. I can use the same reasoning for a volume and refer to the speed of the volume as speed c. Because a line or area or volume has speed c associated with it, I often simply say that the speed of space is speed c. This includes all lines, areas, and volumes.

I must now address the concept of something analogous to a point in classical time and space. In distance-time theory, all time and space is given via particles, and this is also true for a stationary location. The $1/2$ wavelength of a particle is analogous to a point location in classical time and space using the following reasoning. I shall describe a classical point as not having any differences of location within it. This is essentially the same idea as nonlocality. Within the $1/2$ wavelength of a particle's waviness there is no difference of location. Hence the $1/2$ wavelength of a particle in distance-time theory is analogous to a classical point.

I shall use another analogy. If I were to measure within classical time and space, my hypothetical classical measuring device (ruler or clock) could not make a measurement any smaller than the diameter of a classical point. In distance-time theory, my real-life measuring devices cannot make a measurement any smaller than the $1/2$ wavelength of the particle being used as a measuring device or part of a measuring device. Once again I conclude that the $1/2$ wavelength of a particle in distance-time theory is analogous to a classical point.

11) The cosmic simplicity of the distance-time structure

The theory of distance-time gives the appearance of complexity because it uses an ocean of eventons to describe all time and space. However, this is all that is needed to describe time and space for the entire cosmos. An observer may witness eventons moving in different paths from curved to slanted in different frames of reference. Any observation of eventon path movement is simply how the absolute reference frame is behaving in response to what is happening in reference frames slower than the absolute frame of reference. The latter reference to an absolute reference frame is referencing the ocean of eventons traveling at speed c [16]. Whichever manner they behave in relative to the observer in slower frames is dependent on the slower frame or what is happening therein. In conclusion, the holistic cosmic description of time and space for every frame of reference of any rest or relative motion is given by this single ocean of eventons.

In contrast, in Galilean relativity, a structure of time and space is totally relative to its reference frame. Then there are transformation equations linking the frames of reference. This means that to describe the holistic cosmic description of classical time and space, every frame of reference and its respective time and space structures and all of the transformation equations between each other must be used in the description. This would be huge and complex.

In summary, an ocean of eventons describing all time and space is simpler than the classical approach to the holistic cosmos' time and space structure.

12) Discussion

I began this paper with the essence of distance-time theory being about quantum probability and the creation of time and space. I discussed the internal and external waviness rule and the distance-time light cone. Then I discussed tunneling, entanglement, and time travel speeds. In the next two chapters, I delineated about quantum waves that act like particles and the loss of the waves' medium when measured. Finally, I delineated the basics of distance-time geometry and its holistic cosmic simplicity.

Originally, I never intended to create a quantum theory of time and space. I did not go looking for it. I only began my query into elementary quantum theory shortly after I derived my first paper on distance-time theory. Before then I was totally focused on relativity. After devoting some time to pure contemplation of elementary relativity (special relativity), I came to the conclusion that the advent of the discovery of relativity meant far more than just a mere adjustment of classical time and space so as to make it into the four-dimensional space-time continuum. I believed that science needed a whole new understanding of time and space; hence, I set out to build a new structure from scratch. After many years, I derived distance-time theory as an alternative to the four-dimensional space-time continuum. However, there was a problem. For example, if an object was sitting in a classical time and space manifold, it would be in every reference frame that is possible within that manifold. The same should be true of any type of manifold, including a distance-time manifold. However, this creates a conundrum for distance-time theory, because in that manifold an object would be in the realm of both locality and nonlocality. How could an object be located in one spot at speeds slower than c and at every spot at speeds equal to or faster than c?

Essentially I had came up with a three-dimensional construct of time and space that had nonlocality therein, similar to quantum theory, which also acts nonlocally [10-14]. This eventually led me to develop distance-time theory into a quantum theory, which solved the conundrum of an object residing in both the local and nonlocal realms. I believe that the many aspects of this approach I used for a quantum time and space theory still need further development. Nevetheless,the end result of this paper is a time and space structure that addresses quantum behavior including its strange aspects such as tunneling, entanglement, and time travel.

For decades, physicist have done many things to the four-dimensional space-time continuum such as adding additional dimensions. They have also applied it to various gravitational theories. I have essentially thrown it away and started again from scratch. The end result was me writing my first paper “The Theory of Distance-Time” and now this paper “The Quantum Essence of Distance-Time Theory” [1].

Furthermore, the most confusing thing about distance-time theory is that all objects have no spacial location relative to other objects at speeds faster than speed c . However, when I add the probability realm to the distance-time construct, this gives an instantaneous probabilistic location to all objects relative to each other. But this is not distance-time and is not measurable. This is a proto-distance-time which is a distance-time that is in the process of being made. It is the transitory distance-time because it is in between going from no distance-time to a measurable distance-time. Therefore Saturn does have an instantaneous probabilistic location separated from Earth by a proto-distance-time. Therefore proto-distance-time is instantaneous.

Finally, light cones are made for observers with a reference frame that is the same as for matter. They do not apply to the reference frame of light in a vacuum. The imagination can go anywhere, even to places where matter cannot travel. Someone might argue that if matter cannot go there, would it break the laws of physics to allow my mind to go there? The answer is no, because light can go there. As a result I am imagining what is light’s reference frame for time and space. Therefore, this does not break nature’s laws, and I can imagine that within a photon’s reference frame there is no realm of locality. All time and distance are totally nonlocal to the photon. I mentioned this in my theory of distance-time [1]. This means that starting at speed c, reference frames experience no time and space. In actuality, I can not even describe a traditional reference frame without time and space. I just give this realm a nonlocal rule.

Eventually some sort of calculus needs to be developed out for this intrinsically quantum time and space structure.

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