Space, Time, Divergence and Gradients

Robert Kersten
robert@multidimensionaltime.com

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Abstract.

In this paper, the concepts of Scalar Time and Scalar Space as the fundamental expansion and contraction of matter is explored. These ideas are based on Dewey Larson's Reciprocal System Theory and shed a whole new light on what might be happening with matter, both seen and unseen. The mathematical operators, Divergence and Gradient, are used to show how 3D Space and Scalar Time is connected to 3D Time and Scalar Space.

1 The breath of the universe

One of the recent discoveries in cosmology at the end of the turn of the last century is that our physical universe is expanding. The galaxies are moving away from us and from each other, meaning that space is expanding. This expansion is what can be described as a scalar expansion, where all points are moving away from each other.

The force that counters this expansion is gravity. This gravity is pulling matter into the galaxies, increasing the matter contained in the galaxies. Gravity pulls all matter towards mass in such a way that all the points in space move closer to each other. So gravity is a scalar contraction. This idea is fundamental to the Reciprocal System Theory [RST] [1].

The concept of opposing forces is fundamental to physics, as Newton's third law states. In the Reciprocal System Theory, Mr. Larson states that space and time are two fundamental forces of scalar expansion and contraction in spacetime. So if the fabric of space is expanding in a scalar manner, that is in all directions at the same time as cosmologists have measured, then opposing force in our spacetime is the contracting of the fabric of time. This is built into the relationship of space and time, where speed is the ratio of scalar space TO scalar time. The speed which is used is the speed of light. This ratio tells us that scalar space is equivalent to 1/scalar time. If the fabric of scalar space is expanding, the fabric scalar time has to be contracting for this ratio to be true.

The most fundamental part of this structure is the scalar expansion and contraction of space and time. Think of a balloon as the representation of breathing in and out. The expansion, or in breathe, causes all points to move away from each other. The contraction, or out breathe, causes all points to move closer together.

A good analogy, used by Dewey Larson in his RST theory [1], is a balloon. I have modified that analogy to highlight some important details. If a balloon is filled with air in a cold room and then brought into a warm room, the increase in heat will transfer to the air molecules, which then vibrate more vigorously. Each

molecule will then push every other molecule away from it and the balloon will expand uniformly in all directions, that is, a scalar expansion. The opposing force will be the electromagnetic attraction between the molecules of the balloon. In this case the balloon expands because the energy of the vibrating air molecules is greater than the attractive force of the balloon molecules.

If the same balloon is brought outside into the cold weather, the molecules will lose energy through the loss of heat and each molecule will move closer to every other molecule as the contracting electromagnetic force of the balloon molecules, contracting uniformly in all directions, is now greater than the outward force of the air molecules inside the balloon. This results in a scalar contraction.

In the Reciprocal System Theory, photons are fixed locations in this three-dimensional scalar field and are carried along by the expansion, or contraction. Any displacement from this uniform expansion, or contraction, for whatever reasons, results in a motion that has direction in 3D Space, that is, has a specific direction. Those not familiar with the math of scalar and vectors might find this odd, but when a phenomenon has uniform motion in ALL directions, it cannot have a specific direction and therefore is not described as a vector.

So this scalar expansion and contraction is THE fundamental motion of spacetime. It is the cause for the expansion or space, or the contraction of space, and it the second case, is the phenomena call gravity since all points in space are always moving closer together. The diagram below shows this scalar expansion and contraction. The green circle represents unit velocity, that is, motion at exactly the speed of light.

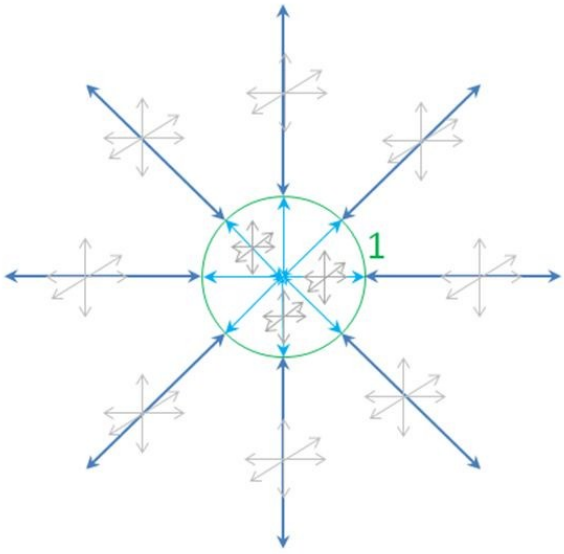

Figure 1. Scalar motion moving vector origins

2 A new ruler

When we measure matter in 3D Space, the ruler used goes from 0 to +/- infinity and this works well. But for spacetime, especially with the addition of 3D Time, a new ruler is more effective, one that measures in *terms of motion*. In this ruler proposed by the Reciprocal System Theory, the origin is *one*, instead of zero. To the right, the numbers to go infinity. To the left, the numbers go to 1/infinity, or effectively zero as shown in Figure 2.

Both space and time are quantized, so the units of space can be written as n units of space [n*s] and the units of time as m units of time [m*t]. Velocity then becomes n*s/m*t. For fixed unit(s) of time, as n increases, the velocity goes to infinity. [1]

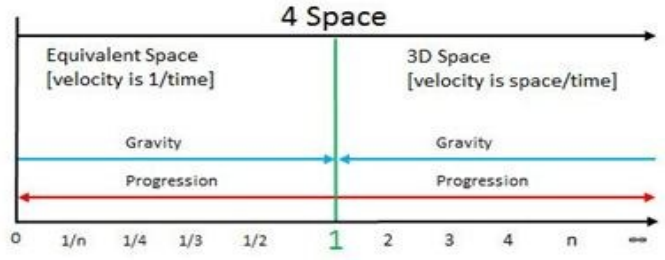

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Figure 2. 4Space measurement

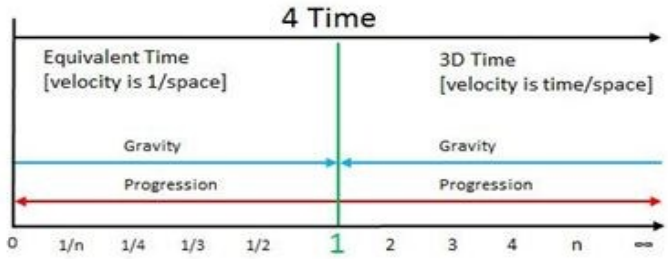

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Figure 3. 4Time measurement

For fixed unit(s) of space, as m units of time increases, velocity approaches 1/infinity. The ratio where n units of space equals m units of time is the speed of light. The speed of light is represented as 1 on this ruler. What will be immediately obvious is there are a multitude of ways to get the speed of light.

An important perspective to keep is that the space between 1 and infinity and 1 and 1/infinity are equal. This is key, since coming from our bias here the 3D Space, the space between 0 and 1 is a tiny fraction of the space between 1 and infinity. Interestingly, from the perspective of 4Space, the volume greater than 1, 4Time looks extremely small, which is the way it manifests in 4Space. It is odd for us to understand that a whole other universe manifest in this place between 1/infinity and 1. Our familiar 4Space manifests in the same place, between 1/infinity and 1 in 3D Time within 4Time. So from that 4Time perspective, it could be hard to understand that a whole other spacetime reality, ours, manifests in such small dimensions.

3 Applying this new ruler

In this reciprocal relationship between space and time, the expansion and contraction forces of the universe, there is a balance. This balance is called the gravitational limit by Mr. Larson. Inside the gravitational limit, the contraction of time, manifesting as gravity, dominates over the progression forces [expansion] of space and matter is accrued into larger and larger masses, increasing the density of mass in 3D Space. Outside this gravitational limit, the progression [expansion] of space dominates over the contraction forces of gravity [time], decreasing the density of mass in 3D space. The thicker arrows in Figure 7.4 denote the dominance of one scalar motion over the other.

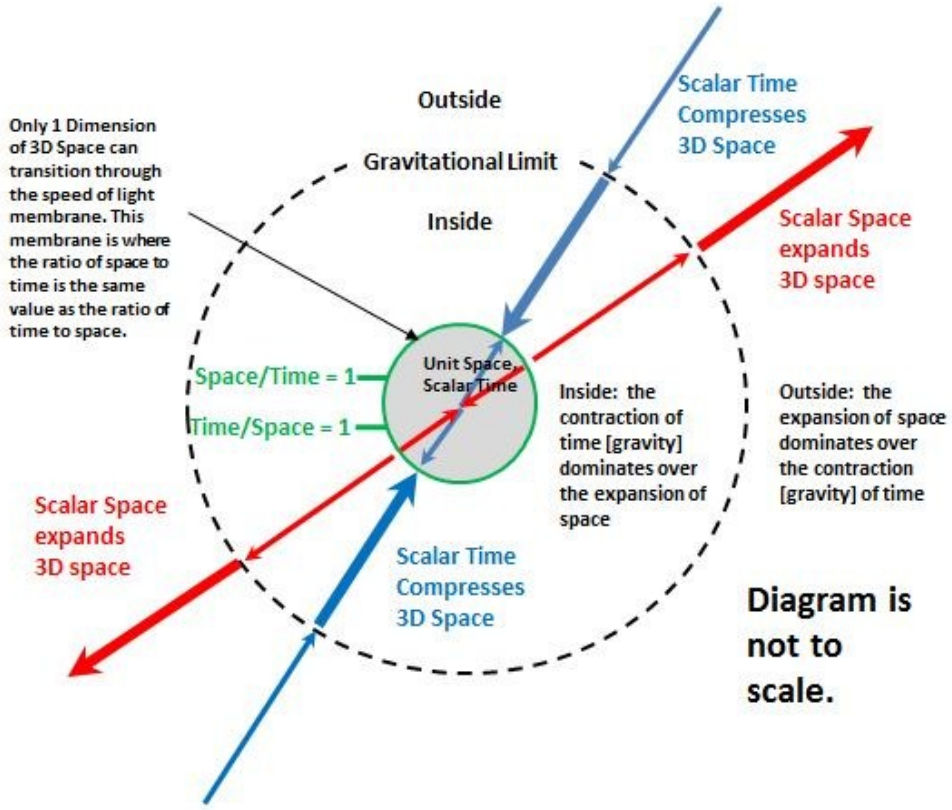

Figure 4. Balance of scalar fields from 3D Space perspective

In the model shown in Figure 4, the fabric of Scalar Time is contracting, which would be identified as gravity, and fabric of Scalar Space is expanding, which would be identified as the results of Dark Energy.

The circle in the center, identified as 1, is where space/time equals time/space which equals the speed of light. This represents a boundary where the properties of either 4Space, or 4Time, can only be transferred through as a scalar property which is the scalar ratio of space/time [speed of light]. I visualize this boundary as a membrane and will call it the Unity Membrane, since velocity is exactly the speed of light in both 4Space and 4Time. That is, dx/dt equals dt/dx which equals the speed of light.

The analogy I use for this Unity Membrane is the cellular membrane of a biological cell. The membrane keeps the biological activity outside the cell separate from the biological activity inside the cell. But the membrane has channels that allow information from what is happening outside of the cell to be transferred to the inside of the cell, changing what is happening inside the cell.

In this cellular membrane analogy, I think of the channels in the membrane as limiting the motion outside the cell to one dimension. This would be the same as taking the three-dimensional motion outside the cell and converting it into a scalar value, which is transferred to the inside of the cell. The activity inside the cell is then affected by the value of this transmitted scalar value.

Now with that analogy, let's apply this to the more complex relationships that are happening between the outside and inside of the spacetime membrane. Outside this unit membrane, in 3D space, Scalar Space is measured to be expanding, so expanding from 1 to infinity. Scalar Time, in opposition to Scalar Space

is contracting from infinity to 1. As mentioned before, inside and outside the gravitation limit, one of these scalar force dominates over the other.

Inside the unit circle, Scalar Space is still expanding from 1 to infinity, but now this infinitiy is in time. As the ratio of space to time dictates, from the perspective of space, this expansion to infinity of time is equivalent to 1/infinity time, so the expansion of time to infinity appears as a motion towards zero in space. Scalar Time is contracting from infinity in time to unity, but from the perspective of space, this is a motion from 1/infinity to one, so looks like an expansion. So the same motion of Scalar Space and Scalar Time has the reciprocal effect in the different spacetime realities from the perspective of either 3D Space, or 3D Time.

Unit velocity of the Unity Membrane is the equilibrium energy between space and time. Any change from this speed of light is considered deviations, or perturbations, from the speed of light. Where the deviations results in a decrease the units of space, or increase the units of time, the velocity slows down. Where the deviations results in an increase in the units of space more than the units of time, or the decrease in the units of time is more than the decrease in units of space, the velocity becomes greater than unity. These deviations from unit velocity are no longer part of the scalar expansion or contraction, but become *vector manifestations* in 3D Space, or 3D Time. These vector manifestations are the same three dimensional spaces shown in Figure 1. Reciprocal System Theory [2] defines velocity in time as greater than unity and velocity in space as less than unity.

4 Oscillating Space and Time

The relationship between 4Space and 4Time, as detailed in the Reciprocal System Theory [1] is through the scalar property of the speed of light, which is the scalar ratio of space *to* time. This relationship limits how the vector properties of 4Space can manifest in 4Time and visa versa. A vector can have a magnitudes along all three axis of 4Space, but only one magnitude can be transferred to 4Time through this scalar ratio of space to time. For example, let's say there is an object in 4Time that has vector orbital angular momentum. Let's say define that only the magnitude along the z axis of this object in 4Time manifests in 4Space. In 4Space, this scalar magnitude manifests as a value between zero and some plus or minus maximum. This would be true for all vector phenomena happening in 4Time, where in 4Space we would only see one scalar value representing that vector phenomena.

One consequence of this ratio of space to time is that space and time have a reciprocal relationship. The effect of increasing space has the same effect on speed, space divided by time, as decreasing time. In the Reciprocal System Theory, there is a Natural Reference which is the expansion or contraction of the fields, either vector or scalar, in that spacetime. The spacetime realities of 4Space and 4Time work in opposition to each other, in other words, *for every action there is an equal and opposite action* as Newton stated so many centuries ago. So if the Vector Space is expanding in all directions, then Scalar Time is contracting to oppose this action. This maintains a balance in the universe.

If the locations of two particles are very close in 4Space, their locations in 4Time will be very far apart. If two particles are moving in opposite directions at the speed of light away from each other in 4Space, they are moving closer and closer together in 4Time. Their close proximity in 4Time could be the explanation for the phenomena of entanglement, where two particles instantly conserve the property of spin between then, even thought the distance between the particles is measured in light years.

The oscillation between 4Space and 4Time spacetime realities is covered in the Multidimensional Time book [3]. One spacetime is always progressing, that is expanding, where every location in that reality is moving further apart from every other point, much like molecules of air do in an expanding balloon. In

response to this expansion of one spacetime, the other spacetime is contracting. This contraction manifests as a gravity, since it brings all locations in that spacetime closer to every other location. It is the net balance of these two opposing forces that determines just how fast the observable expansion or contraction is happening in the spacetime reality one is in.

The existence of these two spacetime realities appears continuous, but it is postulated that at a deep level of reality, the universe is oscillating between these two spacetime realities. An analogy would be the 3D movies that we go to see. Two slightly different versions of the same movie are interlaced and so their presentation to us is oscillating between these two versions at a fast enough rate that our brain puts together these two different versions and gives us the experience of one continuous enhanced 3D version of the movie.

This oscillation of the photons between 4Space and 4Time, in one moment expanding and the next moment contracting, could account for the jittermotion inherent in the Zero-Point field. If the net jittermotion is zero, then no kinetic energy is measured coming from the tremendous potential energy stored in the Zero-Point Field. But if there is a small asymmetry between the expansion in one spacetime reality and the contraction in the other, then there will be measurable kinetic energy, which manifests as this jittermotion.[3]

Everything we are made of, our bodies and everything in the world around us, is oscillating between these two universes. If the building blocks are oscillating, so are we as humans. Remember the analogy of our eyes, without motion we cannot see, but we are not aware that our eyes are constantly moving at around three Hertz all day, every day. So it seems our sense of the universe appears continuous, but it is oscillating at some extremely rapid rate between 4Space and 4Time.

I am not sure if the duty cycle would be exactly 50%, that is we exist 50% in one reality and in the other. Notice I did not say exist half the time in one and half the time in the other, since time is a property of both of these realities, and the fundamental reality underlying both of these universes is ***motion***. Since we primarily identify as beings moving through 4Space, a movement of 50% in multidimensional Space is equivalent to a movement in multidimensional time of 1 / Space. The same movement, but the experience of the movement in time would be very short.

Dewey Larson really stresses motion to help get us out of our common perception of 4Space. With motion, space and time are automatically generated. What generates the original motion is another topic.

Naively, the default assumption is that the setting for duty cycle between 4Time and 4Space would be 50%. But should it be limited to that? What if you could change that? As you increase the time duty cycle, I would expect that more and more matter should become invisible to us, since time is not observable to us. Also, does matter become less dense, more gaseous or liquid-like as time increases? There is no way to be sure. Nature is always moving to a place of balance, so it is likely that the balance of 4Time to 4Space is manifested in a way that allows just the right amount of energy to come out of one spacetime to another to support the universe as we know it.

If energy density in time is 34.6 billion times greater, maybe that might lead to some insight as to why in the ratio we call the speed of light, we have such a large distance [space] for a relatively small increment period [time]. The speed of light in our material universe might have to be this way to offset this huge energy density in time. The theory of Stochastic Electrodynamics shows that even a small change in the balance of the universe would result in huge changes, given the incredible amount of potential energy locked up in the Zero-Point Field. So, thankfully, these variables are remarkably balanced and constant over time.

5 Transforming 3D to Scalar and Scalar to 3D

In these two domains, we have two components of space and two components of time. In 4Space we have Scalar Time, and in 4Time we have Scalar Space.In the Reciprocal System Theory the explanation of the coupling between 3D Space and Scalar Space, or 3D Time and Scalar Time, is the speed of light.

How do 3D Time and Scalar Time, as well as 3D Space and Scalar Space, relate to each other? We know that 3D Space and 3D Time have vector properties, and so have directional properties, whereas Scalar Space and Scalar Time do not. In mathematics, there is an operator called 'divergence,' which turns a three-dimensional variable into a scalar variable. So 3D Space can be converted into Scalar Space, and 3D Time can be converted into Scalar Time. But what about the other way around?

There is another operator, called 'gradient' that takes a scalar variable and turns it into a three-dimensional variable. Scalar Time can be turned back into 3D Time, and Scalar Space can be turned into 3D Space. In this way, there is the ability to have feedback between Scalar and 3D Space and Scalar and 3D Time. [4]

6 How it all fits together

Let's look at these transitions between 4Space and 4Time universes closely, so that we might understand the relationship between them. That means that at any point, we are either in the 4Space universe [observable 3D Space and unobservable Scalar Time] or the 4Time universe [unobservable 3D Time and unobservable Scalar Space].

In the first state, the observable local particle-like 3D Space and the unobservable nonlocal wavelike Scalar Time associated with 4Space universe is active. Here, Scalar Time generates change in 3D Space through motion, that is 3D Space divided by Scalar Time. This motion in 3D Space is the only part that is observable to us [black arrow pointing up shows direction of change]. In the next state, the unobservable local particle-like 3D Time and the unobservable entangled nonlocal wavelike Scalar Space associated with 4Time is active.

How does this first transition happen between 4Space and 4Time universes? In this first transition, two actions happen simultaneously. In one action, all the local information of motion from 3D Space is captured and distributed into Scalar Space. This information of space is now nonlocal, and so is entangled and available everywhere in the unobservable 4Time universe. From our perspective in the 4Space universe, both are unobservable.

In the second action, the nonlocal distributed Scalar Time information from 4Space is localized into 3D Time information in 4Time universe.

To visualize these transitions, it might be easier to also follow along the progression shown in Table 1 below.

Universe	4 Space	4 Time	4 Space
State	Observable	Unobservable	Observable
Motion	3D Space/Scalar Time	3D Time/Scalar Space	3D Space/Scalar Time
Change from Scalar to 3D	Here Scalar Space from previous step[not show] expands into 3D Space	Here Scalar Time from previous step expands into 3D Time	Here Scalar Space from previous step expands into 3D Space
Local	3D Space	3D Time	3D Space
Arrows of change			
NonLocal	Scalar Time	Scalar Space	Scalar Time
Agent of change	Here, Scalar Time is the change in 3D Space	Here, Scalar Space is the change in 3D Time	Here, Scalar Time is the change in 3D Space
Dimensional change	Local Information from 3D Space is compressed into Scalar Space and now all the change that happened in 3D space is nonlocal information available everywhere in 3D Time	Local Information from 3D Time is compressed into Scalar Time and now all the change that happened in 3D Time is nonlocal information available everywhere in 3D Space	Local Information from 3D Space is compressed into Scalar Space and now all the change that happened in 3D space is nonlocal information available everywhere in 3D Time

Table 1. How it all fits together.

In the transition 4Space to 4Time, the localized information of 3D Space is converted from three dimensions to a distributed Scalar Space value [black arrows pointing bottom right]. At the same moment, the distributed information of Scalar Time is converted into the localized information of three-dimensional Time [gray arrows pointing top right]. Here, motion, or change, is created by 3D Time interfacing with Scalar Space in the form of motion. This motion is 3D Time divided by Scalar Space, or relative to us in 4Space, it is 1/velocity in space.

Now, the next transition is from 4Time back into 4Space. The information, which has changed during its existence in unobservable 4Time, is transferred back into 4Space. In 4Time, change acted on 3D Time by interfacing with Scalar Space through motion. This changed and localized information in 3D Time is converted into the nonlocal distributed Scalar Time. This action makes the changes that happened in 4Time nonlocal and available everywhere in the 4Space universe.

The unobservable distributed information from Scalar Space is converted back into observable localized 3D Space, so all the information that was available everywhere in 4Time, and changed during its existence in 4Time universe, is manifested locally in the changes of 3D Space

I can summarize this flow of change as follows.

1. In 3D Space or 3D Time, change happens with motion in a localized way.
2. In Scalar Time and Scalar Space, change happens in a distributed or entanglement manner.
3. In the 4Space universe, Scalar Time is the agent of change for 3D Space through local motion. In the transition to the 4Time universe, this change in information is captured and compressed into Scalar Space, and through entanglement, it interfaces with all other motion. Think of a three-dimensional matrix of balls, where each one is connected to surrounding balls.
4. In Scalar Space, through entanglement, every part of the universe interacts with every other part of the universe. This Scalar Space information is the agent of change for 3D Time via motion, but, in this case, time divided by space.
5. The second transition back to the 4Space universe again, the nonlocal entanglement Scalar Space from the 4Time universe is expanded into 3D Space, but with the changes from the entangled Scalar Space state. The changes made on 3D Time by Scalar Space while in the 4Time universe is compressed into the entangled nonlocal Scalar Time state of the 4Space universe, our familiar version of time. So when 3D Space is divided by this potentially changed Scalar Time, there is the potential for a new motion in 4Space. The small changes between the two static images of a motion picture represent the changes that happened in the 4Time universe. This switching is happening at extremely fast frequency.

7 Conclusion.

In this paper, the fundamental forces of spacetime are scalar space and scalar time. The phenomenon of the missing mass of Dark Matter could be the result of the contraction of Scalar Time dominating the expansion of Scalar Space near very large mass. The phenomenon related to Dark Energy could be the result of the expansion of Scalar Space dominating the contraction of Scalar Time a distance away from large masses.

The two spacetimes, 4Space and 4Time, are coupled together through the scalar speed of light, and proposition is that the two spacetimes oscillate as some extremely fast rate,make both spacetimes appear simultaneous.

Due to the fact that the basis of all electromagnetism in 4Space is static or moving electrical monopoles, I label 4Space as Electric Space. The same is true for 4Time, where magnetic monopoles form the basis for electrodynamics, and so I label 4Time as Magnetic Time. With the addition of antimatter, Electric and Magnetic Photons are proposed.

The idea of how these two spacetimes are balanced, that is the duty cycle of the oscillation between the two, leaves even more intriguing thoughts in additional to all those proposed in this chapter already.

8 References.

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