Composite Dimensionality:

The Origin of Force and Motion

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Abstract:

Composite dimensionality represents a new way of looking at the universe through a detailed analysis of the concept of motion. Motion has, from the time of Zeno of Elea twenty four centuries ago, represented a great unknown. The most interesting fact is that the universe needs nine dimensions to fully account for all forms of one-dimensional motion. Physics, viewed in nine dimensions, becomes almost classical again - both quantum mechanics and relativity theory are revealed to be nothing more than distortions of fundamental parameters brought on by the way nature needs to fit the information flowing in nine dimensions into the three spatiotemporal dimensions we can perceive (it's not a perfect process). This, of course, is not a new concept. Unfortunately, the methodology of dimensional compactification previous theories utilize as a means of dealing with the 'extra' dimensions is not correct. Composite dimensionality completely does away with dimensional compactification, as it reveals the true way in which the nine basic dimensions are handled by the universe, as well as answer the basic question of what, exactly, are the three dimensions we currently reside within.

Quantum mechanics is one of the most successful theories we have derived in terms of answering questions concerning the nature of the universe. However, there are few if any scientists that think quantum mechanics is a complete theory. In some areas, such as the nature of single particle action, and particle pathways, the theory falls flat. Perhaps there is some part of the quantum story that we do not yet understand? But if this were really the case and we are using an incomplete theory, then how can this incomplete framework be used to make accurate predictions about anything at all? It does seem to be a bit of a puzzle, doesn't it? Perhaps it is not that quantum mechanics is incomplete, but our way of thinking about the universe itself that is lacking.

This is a roundabout way of saying perhaps we should examine more closely what we mean when we talk about the path a particle can take or how a particle can move. Actually, the concept of motion in general is an area of thought that has occupied the human mind for a very long time. So, I feel it is fair to ask the simple question: Do we know what motion really is? Perhaps not…

24 centuries ago, the Greek philosopher Zeno of Elea came up with several thought experiments showing that motion is not possible. Simply put, to get from where you are to where you want to be, you must get halfway there first. Before you can get to the halfway point you need to get again, halfway there, and so on unto infinity. Zeno felt that because there were an infinite number of halfway points existing between any two places, that motion is not possible because it would take an infinite amount of time to cross an infinite number of finite-in-extent halfway points. I have greatly simplified Zeno's four motion paradoxes, where he argued using logic that nothing moves. Of course we know he is wrong, and historically it isn't known with certainty whether Zeno himself believed motion was impossible or whether he propounded his paradoxes simply as a defense of his teacher Parmenides' ideas [1]. All one has to do is to look at something moving to know that motion really occurs. It seems self-evident doesn't it? Things change position all the time. To sum up: by observation and definition, 'movement' happens when some object changes its position with respect to time, and 'motion' is the action or process of moving. This is what our eyes tell us, and 'seeing's believing', right? Our eyes would not tell us lies would they?

It is a common belief today that Zeno's classical paradoxes of motion have been done away with by the invention of calculus.[2] Using calculus it is possible to show that an infinite series can converge to a specific, finite, quantity. So, that is that. But wait, not so fast. True, calculus is an invaluable tool that allows for a numerical solution to textbook examples of motion problems, but it does not speak to the underlying cause of motion. Zeno's peculiar paradoxes speak to the heart of motion, its causative agent, and the engine behind the phenomenon - the abstruse 'process' behind the previously mentioned definition for motion. Calculus just doesn't deal with this aspect of motion, it only provides a numerical answer to a given motion problem. Using calculus to provide a quantitative answer to a motion problem serves as a Band-Aid which conveniently covers up our conceptual ignorance as to how motion occurs. We still do not know what the engine of motion is and Zeno's paradoxes are still very much alive in the 21st century.

The problems we have with motion are reflected in quantum theory. Being a statistical theory it is not really set up to answer questions concerning individual particles – how they may act in a particular situation, or how they undergo motion. It gives accurate results when dealing with large aggregates of particles but even then the theory does not say anything concerning particle motion. It seems the problems first elucidated by Zeno over 24 centuries ago are still reflected in current-day thinking, much to the detriment of any theory we could possibly come up with. When seen in this light the fact that quantum mechanics can be as accurate as it actually is, seems something of a miracle.

It is my assertion that if we understood motion better than we do currently, the problems inherent in quantum theory would evaporate, revealing a much more tone, muscular theory that is also easier to understand and use.

A Universe Where Nothing Moves

Motion is an illusion.

Zeno came to the above conclusion 24 centuries ago. Can any part of his premise be correct? Is there any way we could actually be living in a universe where motion is not possible? Despite our senses, the fact that each one of us experiences what we think of as motion, it is possible he was right. Because we can easily detect when movement has occurred, when some object has changed position, the only way this could be true is if motion could be divorced in some way from movement. Motion and movement are so tied together that they seem interchangeable, and in fact many use those words interchangeably. But they're not the same thing. As I said earlier, an object's change in position is called movement, and motion is the process that causes movement. But what, exactly, is that process? In short, what exactly is motion? If the subject of the sentence is movement, then motion is the verb. So, what is the process behind this particular verb? Now, at some level it is an applied force that sets up the conditions necessary for motion to occur, and an applied force involves the application of energy to a system. So at this basic level the flow of energy into (or out of) a system is what causes something to move, to change position. But, this isn't a very satisfying explanation because when we say 'flow of energy', we are talking about the motion (of energy) to define movement in a system. This is saying motion defines itself, and is not very useful.

Of course, not having a good definition for motion doesn't mean movement cannot occur. You really need to ask yourself precisely what you are observing when you use your eyes (or preferably, a recording apparatus) to observe movement. For example, when you observe a snail crawling slowly over the surface of a leaf what can you really say about what you are observing? In this example you can say that the snail is changing position, or, simply, moving. You know this because you can easily compare the results of ongoing measurements you have taken of the snail's position over a certain time interval with some type of recording apparatus to know there has been a change in position with respect to time. Or you could simply watch the snail, using only your eyes and keen memory to keep track of things. But, no matter how you cut it, what you see or measure is movement, not the mechanism that creates the movement, which is motion. This is a subtle yet important point. You are viewing the end result of a process you cannot perceive, namely motion, and calling it movement.

Some may object to this result, saying it is too restrictive. They may say that they are seeing motion occurring because they discern the snail changing position fluidly in real time as it is happening. This particular aspect of motion is, as Zeno would say, an illusion. To understand why, just ask yourself what motion would look like if you could turn off memory. Without the ability to remember past positions of the snail, how could the observers brain create any kind of path at all, let alone attempt to predict where the snail may likely end up in the future? In this regard, what most people would commonly call motion is organic in nature, an artifact created in their own heads and not something actually observed.

The classical equations of motion work so well because they describe the results of something undergoing positional change in terms of speed or acceleration which gets expressed as a numerical quantity. This is as true for solutions expressed by calculus as it would be for any other type of mathematical methodology. Motion equations therefor do not describe the process of motion, only the results of motion, which is movement. Motion equations are really movement equations.

This conceptual fuzziness extends more deeply than we realize. When we describe motion we invent another term, force, to provide a mechanism for motion to occur through. But it all falls down upon closer inspection because we really don't know what force is either.

On a purely superficial yet functional level, force is just a numerical quantity representing the multiplicative product of mass and acceleration: $F = m \times a$ expresses the relationship between force, mass, and acceleration that forms the heart of classical physics. This equation gives no conceptual clue about the way in which force causes acceleration, only that it does. Like its bigger cousin motion, our definitions leave the juicy inner workings of force a pregnant mystery. Considering everything we either don't know or are ignoring, it really is remarkable that classical physics works as well as it does.

Quantum physics and relativity theory both incorporate within them the quintessence of classical physics, and hence suffer from much the same motion related problems. Within the framework of quantum mechanics, the path a particle takes is not even considered, and in relativity, results describe how motion near the speed of light (which in itself is a sort of ultimate movement) distorts how we view certain phenomena such as length, time, mass, etc. Like classical physics, it is also remarkable how well both these recently developed scientific frameworks describe certain aspects of reality. The problem is that by leaving out the unknown factors; namely how motion occurs, and how force is related to motion dynamics, the three theories we have literally based our entire physics framework on, since at least the time of Newton, risk being placed in jeopardy when intractable problems arise that cannot be decoded.

The physicist Lee Smolin has recently identified a major phenomenological problem with all three mainline physical theories which currently form the backbone of physical science. Namely, none of them are truly fundamental theories which would allow them to describe the universe as a whole [3]. They are effective theories, in that each works within its own domain, but either fails or becomes undefined when used outside its limited arena. Is it any wonder physicists have met with so much difficulty attempting to create a grand unified theory? The problem is they are trying to cobble together a truly fundamental theory using incomplete components. You will never bake a cake by leaving out random ingredients – oh, it may look like a cake at a distance, but the imperfections will become apparent when you try to cut it or taste it.

In order to bake up a true unified theory of mass, energy, and action, it makes sense to begin with a fundamental theory, and that is something we just do not have at the present time. So, what would a fundamental theory look like? It is possible to get an overview of such a theory by looking at some of the things it would address:

1) It addresses Zeno's paradoxes of motion by providing a conceptual mechanism that motion occurs through. This is more than simply providing 'motion equations' that one can use to predict where an object undergoing motion will be at a particular time. In other words, a fundamental theory of motion could be used across-the-board from quantum systems to classical systems to relativistic systems without major modification.

2) It provides a conceptual framework that explains the origins and mechanism of 'force'. What it is and how it acts on mass to cause positional translation.

3) It explains why energy is a conserved quantity.

This newly discovered fundamental theory will not be a glossy, whiz-bang theory like supergravity, string theory, or M-theory, but it will be a grubby, get your hands dirty applications driven approach that can get as primitive, or as high powered as you want it to be for whatever problem you happen to be working on. It's even possible that Newton would be able to read and understand it without going back to school, something I dare say, wouldn't be possible with relativity or quantum physics. It will also save modern physics by displaying new avenues of approach we currently are unaware of to solve currently intractable problems, such as string theory, and also breathe new life into physics at the same time.

So, where do we begin our journey?

If we recognize the problem as stated by Zeno that motion is not possible in our three-dimensional universe, then we have to ask: how many dimensions does it take to account for motion? To answer this question we need to determine what forms of motion can occur in a single spatial dimension, and then multiply the result by three to account for all possible directions in three-dimensional space.

First, obviously, is no motion at all. This would be the simplest case: unchanging position. Next, there is motion at a constant speed. Position that varies in a constant unchanging way with respect to time – this form of motion is also the solution of the first derivative of position with respect to time. Then there is the case of accelerated motion, or the rate of change of speed with respect to time, which is also the solution to the second derivative of position with respect to time.

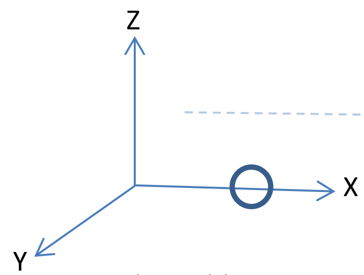
These forms of motion, although related to each other, can be treated as separate cases of motion, each requiring its own dimension to be expressed in. Are there any other forms of one-dimensional motion? Well, the rate of change of acceleration with respect to time is called jerk, but it can be expressed as an acceleration of acceleration. It all boils down to three conditions: no motion, constant motion, or accelerated motion. So, it seems there are only three forms of motion that can occur in a single spatial dimension. Since we are living in a three-dimensional universe, and there are three forms motion can take per each of those spatial dimensions, motion can be thought of as a nine-dimensional phenomenon. This explains why we cannot see it – we can only perceive three dimensions of space. Our brains, being created from three-dimensional matter, cannot perceive anything beyond three dimensions. Looked at in this way, it is now easier to see why Zeno got so hung up on the concept of motion. As he successfully argued, motion is simply not possible (in three dimensions). Intuitively, he somehow knew the only phenomena possible given three spatial dimensions is position, which would lead to an unchanging, eternally frozen in place universe, which, interestingly enough, can also be described as a universe where time doesn't exist or flow. When he watched something move, he was in reality observing the results of a nine-dimensional phenomenon, motion, producing an effect, movement, on three-dimensional matter, and it all looked like magic to him.

The Idea of Composite Dimensionality

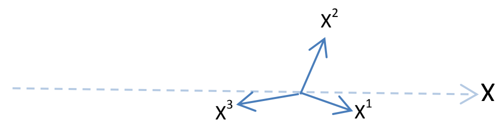
This means the problem of motion reflects a more basic problem in dimensionality. It seems our concept of spatial dimensions needs to be looked at more closely. Although there are many definitions for dimensionality, in physical science a dimension is a measurable quantity. For example, the x-spatial dimension is defined as movement in a certain plane, while the y-spatial and z-spatial dimensions are defined in the same way, where all three spatial extents are at right angles to each other. This begs the question, namely, how can a nine-dimensional phenomena have any effect in this three-dimensional space we exist in? Well, if the nine dimensions motion occurs in were totally disconnected from our three-dimensional world, as is posited in some interpretations of string theory, the answer would be that it couldn't. Historically, in theories where the number of dimensions exceeds the basic three spatiotemporal dimensions of common experience, from Kaluza – Klein theory [4] to string theory [5], the six dimensions that are beyond our perception are treated as almost superfluous. We can be grateful this is not the case else our universe would exist frozen in a single point of time for eternity, and we wouldn't be here to ask the questions! Obviously, the three-dimensional space we live in and the nine-dimensional 'configuration space' where motion occurs, are intimately connected in such a way that we can see the results of action occurring in that higher dimensional place within our own universe.

This is a major point of difference between composite dimensionality and most interpretations of string theory. In the string theory hypothesis, while the existence of nine spatial dimensions is necessary, six of those dimensions are collapsed in upon themselves, through a process called compactification. The six compactified dimensions while still existing do not interact much with the three remaining dimensions of which our universe is created due to their extremely small size and consequently high interaction energy. Some versions of string theory utilize the extra dimensions as a possible way to explain why gravity is such a weak force, but the reasoning behind such an assertion currently has no scientific evidence behind it. The compactification process itself also represents an unknown process. Also unknown is why and how our familiar three dimensions escaped this process, and not some other arbitrary number of dimensions such as four dimensions or seven dimensions. Compactification is an ad hoc addition to string theory. Composite dimensionality does away with the compactification process entirely. In composite dimensionality, all dimensions of the universe are placed on equal footing. All nine configuration dimensions act equally to create our familiar three-dimensional universe in an active process that continues to this very day.

At its most basic level a single spatial dimension is actually not a discreet thing, but is instead a composite entity made up of three parts. If we posit a higher order domain, which is a configuration space, as existing in nine dimensions, then it is possible to generate our 3-dimensional universe, where each spatial dimension we exist within is in fact created by the orthogonal projection of three of these higher order configuration dimensions.



A single spatial dimension…



…is in reality created by 3 configuration dimensions in 9-dimensional space.

So, how does motion occur? In 3 dimensions it appears as if a force is propagated to an object, either via direct contact between itself and another object undergoing motion, or through an electromagnetic or gravitational field, and that causes its state of motion to be altered in accordance with the classical laws of motion. A more modern interpretation of movement is that it is caused by the exchange of virtual particles which act as mediators that carry force between objects. In fact this interpretation is not sufficient because mediator particles must move between objects in three dimensions in order to exchange force information and one is left in a catch-22 situation, using motion to define motion.

Seen in 9-dimensional configuration space, the action is more intricate. Think of the 3-dimensional space an object exists within as being the result of nine configuration dimensions coming together to form a 3-dimensional spatiotemporal domain of action – every point in space is described thusly. Mass, or rather the energy contained in mass, distorts these configuration dimensions so that they are no longer orthogonal with respect to each other. Particles may in fact be exchanged between these moving objects, but the exchange occurs in nine dimensions, not three. This is why mediator particles are virtual - they do their work in nine dimensional configuration space. It is the distortion existing between the nine configuration dimensions, mediated by virtual particles that cause motion in configuration space, not direct contact between objects in three dimensions. In turn, it is motion in nine dimensional configuration space that results in movement occurring in our familiar three space-time dimensions.

For an example, consider a marble rolling on a hard surface which then strikes another, stationary marble, and sets it in motion. Ignoring the contact between the marbles and table for the moment, what is really happening here? Each marble is a three-dimensional object in the center of a 9-dimensional configuration domain. The domain representing the moving marble begins to interact with the domain representing the stationary marble, which begins to distort as dimensional information begins to be shared between the two nine-dimensional configuration domains. When we observe this process translated down to three spatial dimensions, we observe the moving marble coming into contact with the stationary marble which causes both to change their state of motion, all according to familiar classical laws. It is important to realize that there is no force in three dimensions being exchanged between these two objects, that all the action actually takes place in nine-dimensional configuration space. What we observe is merely the result of this dimensional interplay projected into our three dimensional domain.

In reality, motion is an indirect thing. In the above example, it doesn't involve the marble masses so much as it does the configuration domain each marble exists within and the way virtual particles interact in nine dimensions. Of course, the amount of distortion the configuration dimensions experience is due to the three dimensional mass-energy equivalency each marble represents, so it is a shared process. Mass-energy creates the distortions, and it is the distortions that govern the motion of the masses, as well as other physical variables. Also, marbles don't roll in isolation. The surfaces they are resting on each represent their own configuration domain with the resultant continuous two-way exchange of dimensional information defining the state of motion for both marbles. The net result in three dimensions is a well behaved dynamical system which obeys classical motion laws.

Energy – Force Feedback Loop

Energy in 3-dimensional space causes stress in 9-dimensional configuration space …

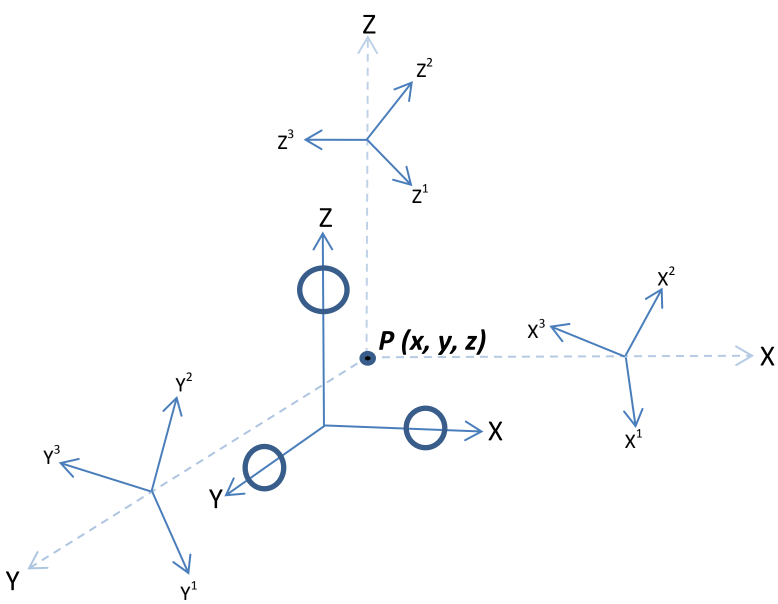
…stress in 9-dimensional configuration space gives rise to force which propagates back into 3-dimensional space and gives energy its particular characteristic.

This seems to be a complicated way to describe physical action, but it is necessary in order to preserve energy conservation, which I will go into in more detail next.

How Motion Relates to Energy Conservation

In this section I will show how energy is conserved in three dimensions due to the way motion occurs in a nine-dimensional configuration space.

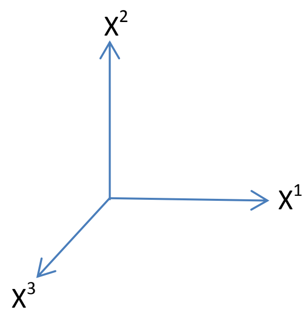
To recap, in the previous section, I explained how each spatial dimension is actually a composite structure made up of three configuration dimensions. In more detail, this means that each point in the 3-manifold that defines our universe is created by the confluence of a total of nine configuration dimensions. If there were a point in the universe devoid of matter and energy such that no stress were placed on these configuration dimensions, then each of the three configuration dimensions that make up each spatial dimension would exist in perfect orthogonality with respect to any of the other two configuration dimensions:



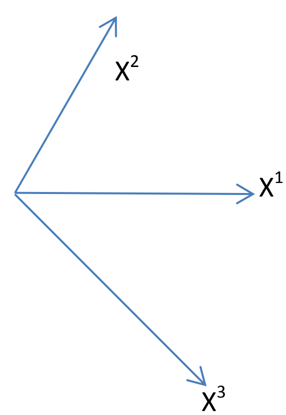
An undisturbed point ***P*** in three-dimensional space is composed of three groups of three orthogonally related configuration dimensions.

This dimensional orthogonality no longer holds when mass occupies a point in space. The presence of a mass or more accurately, mass-energy, serves to create a tension between the three configuration dimensions which causes them to deform away from perpendicularity. The greater the mass-energy in a region, the greater this deformation will be.

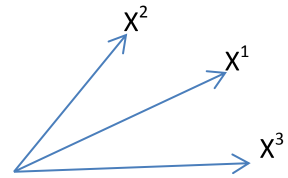
In C-space:



In the absence of mass-energy, the composite dimensions making up a spatial dimension are perpendicular to each other.



Mass-energy causes the configuration dimensions to distort away from perpendicularity.



The greater the mass-energy in a region of space, the more distortion there will be.

It is these deformations that translate into the so-called fundamental forces of nature. It is important to realize that in this view, energy and force are seen as two separate things. Mass (or mass – energy) in a region of space creates the stresses in configuration space that in turn generate the fundamental forces. These fundamental forces in turn shape the energy contained in mass, giving matter its physical characteristic. An explanation of motion begins when two particles, represented by these nine configuration dimensions get close enough to interact, creating more tension that gets relieved by the two particles moving away from each other. Remember, all this action is happening in nine dimensions, not three. A clue to translating this down to three dimensions is to be found in realizing that energy and force are actually separate, but related, things.

So, we must look much more closely at energy, and in doing so reveal some surprising things about what was thought to be a well-known concept.

Energy is truly a conserved quantity. For this to be true in an absolute sense, energy must be temporally transparent. This provides a direct way to explain energy conservation. For energy to be transparent to time, it means that its magnitude can never change, that it exists as a frozen-in-place fossil, a relic whose magnitude was fixed by processes that existed only during the first instants of the universe's existence. The magnitude of energy in a given volume of space can never change.

Also, if time doesn't affect the magnitude of energy, then energy cannot flow from point to point in the universe. It is wrong to think of motion as the physical movement of an object through a point in space, because if that were true then the total energy existing in the mass of the object would be able to add to the energy already existing within a point in space as the mass passes through it. This describes a time evolution which is a disallowed state because at the very least it would imply that the energy of motion would not be conserved.

The total amount of energy contained in a single point in space is truly an outstandingly large number, for it must take into account three things: kinetic energy, potential energy and vacuum energy. Of these three quantities, vacuum energy is by far the largest factor. At any point, the total energy contained in that point, is, kinetic energy (ke) + potential energy (pe) + vacuum energy (ve) which can be conveniently set to unity , so, ke + pe + ve = 1. For total energy measurements, the relative proportions of these three factors can change with respect to each other, but they must always equal 1 for any point in space.

This point bears repeating. Within any given volume of space, the ratio of energy forms can change with time, but not the total amount of energy. If the total amount of energy could change with time, energy conservation would be violated. The major consequence of temporal independence means that our notion of energy 'flowing' from region to region is not correct. Indeed, if energy were able to actually flow, then it would not be conserved and our universe would look completely different. The ratio of the three energy components that exist in a region of space is in direct proportion to, and a consequence of, the amount of distortion each configuration dimension is experiencing.

Getting back to the main subject of this discussion, motion, the question that needs to be asked at this point is this one: If energy cannot flow, then how is even the appearance of motion possible? This speaks to the heart of Zeno's paradoxes of motion, and why Zeno must have thought that motion was an illusion.

To answer this question in a conceptual way, it would be helpful to consider what could be the smallest unit of volume possible in our physical world. Although the exact number isn't really important, due to quantum physical considerations and involving Planck's unit of length as being approximately 1.6×10^{-35} meter, we need to realize this unit is indeed minuscule. There is currently no hope of ever detecting or working with volume units so tiny that they make subatomic particles seem huge by comparison. Conceptually, this volume can simply be thought of as a region containing energy. Because this 3 dimensional region is created by the confluence of nine higher order configuration dimensions, what happens in configuration space can and does have an effect within each quantum volume of 3-dimensional space. Remember from the previous section that the forces caused by matter stressing the dimensions of configuration space can shape energy contained within a volume of 3-dimensional space, giving it its physical characteristic. One of these characteristics is the displacement caused by motion in those nine dimensions. Particles cannot move fluidly in our three dimensions to reflect this displacement, but rather, 9-dimensional motion projects down to three dimensions as a displacement first appearing in one volume region, then another volume region, as the displacement propagates in configuration space.

Seen from our perspective, if we truly could witness pure motion on the scale of individual quantum volumes, motion would not be continuous, but would appear discreet, and mass would first appear frozen in one volume, then disappear to reappear in a neighboring volume in a slightly different configuration to reflect time evolution in nine dimensions, without appearing to exist between volumes. It is not the mass that is actually moving across the boundary of the quantum volume because if it did so it would imply energy was flowing and that is ruled out because of conservation considerations. In actuality, it is the information of what is happening in 9-dimensional configuration space that is seen to 'jump' from boundary condition to boundary condition, manifesting as physical force that causes the energy trapped within those quantum volumes to assume the shape of mass. In addition, the more energetic the process, the more quantum volumes the mass could skip over, which would appear to our eyes as an increase in speed. In this view, kinetic energy is directly related to this 'skip sequence'. The faster something moves, the more quantum volumes get skipped over, and we say it has a larger kinetic energy. Energy, to bring up an analogy, is the raw three dimensional material which universal forces use as putty to shape what we call our physical reality. Those forces in turn, originate in a 9-dimensional world we cannot perceive due to the limitations of the 3-dimensional energy we are made from.

How Motion Appears in Three Dimensions:

The quantum connection

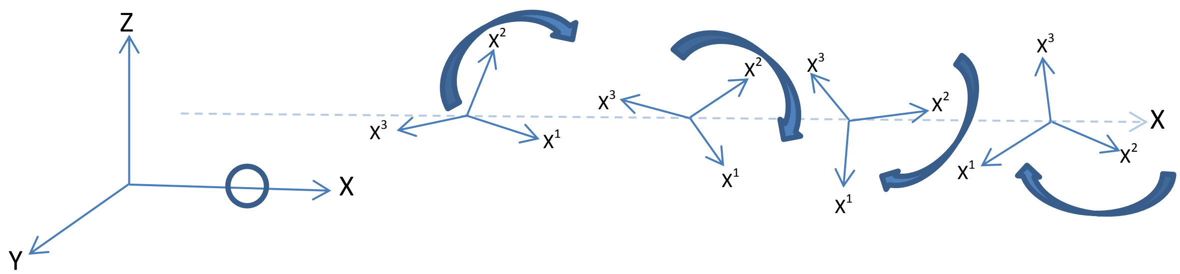
Motion depicted for a snail where speed = 2 inches per minute:

Motion depicted for a snail where speed = 4 inches per minute:

Motion in the above example depends not only on the skip sequence, but is also a function of the duration the object remains bound within the quantum volume. This is so because time must also be represented for moving objects. The concept of time has always had an eneffable fuzziness about it. This is because of our lack of understanding of what the phenomena we call time actually is. In composite dimensionality, time is simply the manifestation of duration in a 3-manifold due to change occuring in a 9-manifold. Remember, when an object is locked within a quantum volume it is 'frozen' for however long it is there. This is because the energy that it is made from is time-transparent. For a given duration, no time evolution can occur. Change can only happen when the object skips to the next quantum volume. As both special and general relativity show all too well, time is also a phenomenon that is related to motion, as relative motion and gravity can alter percieved duration. Temporal ordering, the 'direction' time is observed to flow in, is also derived from the way motion occurs in nine dimensional configuration space. Again, what we observe as the flow of time, or times' arrow, is the direct outcome of a dynamical process happening outside our perceptual realm. We see the end results of this ordering of duration and call it time when in fact the flow of time is as much an illusion as motion is and for the same reason.

Also, the above example attempts to represent pure motion by using the fiction of a particle (or a mollusk) which can be contained in a single quantum volume. In fact, due to the miniscule size of a single quantum volume of space there exists no particle small enough to show the discreet nature of pure motion. The opposite would be true – subatomic particles no matter how tiny would cover many of these miniscule volumes of space, causing their overal motion to be avereged out and appearing as a smooth unbroken track in space. The universe conspires to give us the illusion of pure three dimensional motion where none exists.

Earlier I mentioned that if we understood motion better it could lead to a better understanding of quantum phenomena. An example could be the spin of a subatomic particle. Currently spin angular momentum has no conceptual real-world analogy. It is just a characteristic of subatomic particles that, while having measureable outcomes, has no easy description. In composite dimensionality spin angular momentum arises when the configuration dimensions that create a given spatial axis are themselves rotating. Particle spin is how the angular momentum of three configuration dimensions presents itself in a single spatial dimension for a subatomic particle along its axis of measurement.



Particle spin is caused when angular momentum along a set of dimensions in configuration space is projected into a single spatial dimension for a subatomic particle.

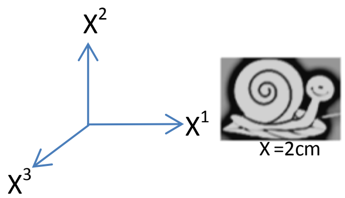
Composite Dimensionality and the Limits of Physical Reality:

The relativistic connection

It should be apparent by now that if continuous motion in nine dimensions can only be expressed as discreet steps in three dimensions, then 3-dimensional motion-related phenomena must in some ways be distorted, compared to the 'pure' motion happening in nine dimensions, and that the total distortion relates to the amount of movement an object undergoes. This distortion will also exist in any physical parameter that is being measured along the direction of motion. A way of defining the amount of distortion of a physical quantity is to first note that the three configuration dimensions that create a single spatial dimension can be conveniently represented as vectors, and the angle each vector makes with respect to the other two is defined by the relative motion as measured between the accelerated object and the observer.

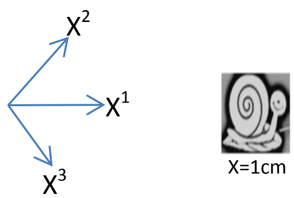
For an example relating length contraction along the axis of motion:

When V = 0:



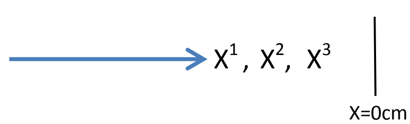
In the case where the motion is zero, there is no distortion in any of the physical parameters of the snail with respect to the observer.

When 0<V<C:



For the case where relative motion is beginning to approach the speed of light, the snail begins to appear foreshortened along the direction of motion with respect to the observer.

When V=C:



For the limiting case where the mass-energy distortion is so great all three configuration dimensions are driven into each other, the snail's length along the direction of motion is zero with respect to an observer. Because of this the speed of light is effectively an ultimate barrier which can never be reached as it implies the snail's relativistic mass becomes infinite.

It is interesting to note that in the above example, it would take an infinite amount of energy to drive the three composite axes into each other to become a single spatiotemporal dimension. This occurs when the energy of motion, or relativistic kinetic energy, becomes infinite at the speed of light. This is a pedagogic way of saying that all true motion happens beyond the light barrier, or that motion itself is a superluminal phenomenon.

It is also interesting to note that within the theory of composite dimensionality, both relativistic effects and quantum phenomena have a common origin. Specifically, they are phenomenological distortions brought upon physical reality because of nature's attempt to fit a nine-dimensional reality within a three-dimensional framework. The process works, with some loss being unavoidable and showing up as the distortion effects of relativity and quantum mechanics. Philosophically, the idea of composite dimensionality brings back the ideal of classical physics, only with more dimensions. Having nine dimensions offers physics enough degrees of freedom to once again become a classical endeavor.

It was William Shakespeare who said in his poem, As You Like It, “All the world's a stage, / And all the men and women merely players; / They have their exits and their entrances / And one man in his time plays many parts,” (II.VII.1-4). In a very real way, our world is much like a stage which is set up to show the results of things, not how those results were achieved. Taking all this into consideration, when you view a common garden snail crawling leisurely on the leaf of a plant, know that what you perceive as the snail’s motion is in fact the result of a process that takes place outside of your perception, faster than the speed of light, in a 9-dimensional world you can have no direct knowledge of due to the fact that the energy you (and we) are created from is only a limited 3-dimensional phenomena.

References

1) Palmer, John, "**Zeno of Elea**", *The Stanford Encyclopedia of Philosophy* (Spring 2012 Edition), Edward N. Zalta (ed.), http://plato.stanford.edu/archives/spr2012/entries/zeno-elea/

2) Lynds, Peter. “**Zeno’s Paradoxes: A Timely Solution**”, http://philsci-archive.pitt.edu/1197/1/Zeno_s_Paradoxes_-_A_Timely_Solution.pdf

3) Smolin, L. (2013). **Time Reborn**, (pp. 107-108), New York: Houghton Mifflin Harcourt

4) Kaluza-Klein (KK) theory, 1926. Overview. http://www.princeton.edu/~achaney/tmve/wiki100k/docs/Kaluza%E2%80%93Klein_theory.html

5) Wikipedia, String Theory, section 1.4 inclusive. http://en.wikipedia.org/wiki/String_theory