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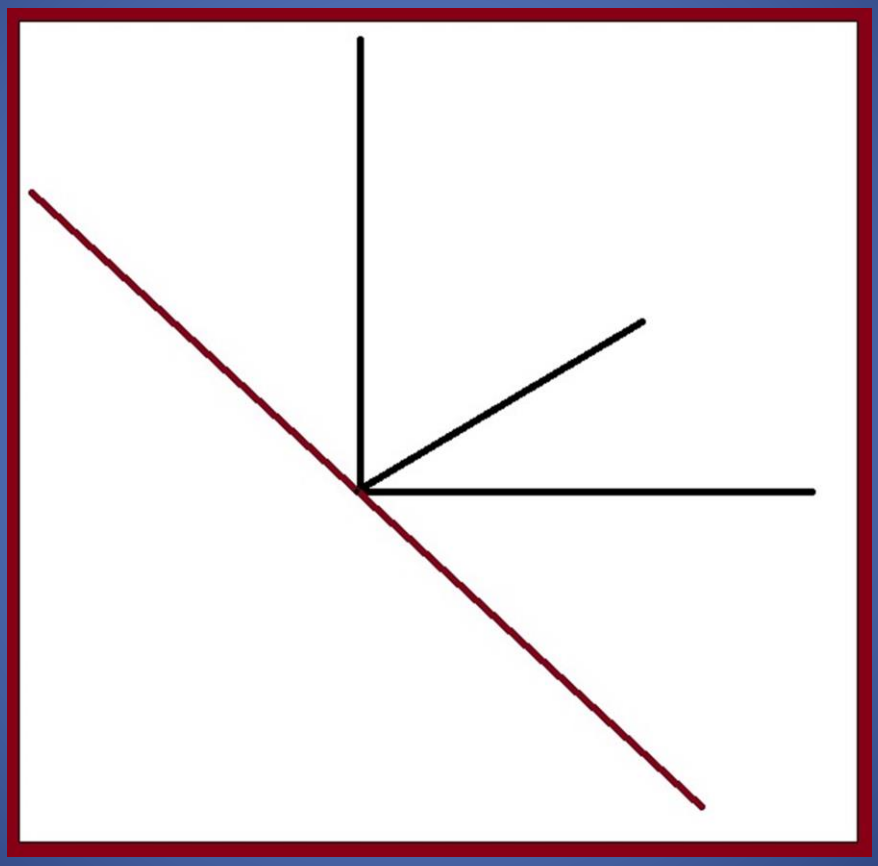

4D BALLOON THEORY

A Scientific Revolution in Physics

By Timothy Patry

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Introduction

This paper contains what the author believes to be the next revolution in physics. Unlike other theories which touch on some facet of physical reality, this theory touches everything touched by Einstein's Theory of Relativity. It spans many topics and challenges many assumptions. It may take several readings to fully grasp the ideas.

The payoff is a model of the universe that explains the universe without requiring knowledge of advanced math. This paper provides a description of the universe without equations. That description is intuitive and interesting and it explains many things that the Standard Model can only ignore.

This paper begins with a discussion of the expansion of the universe and the flaw in the Big Bang Theory illustrated by the concept of Red-Shift. It continues with a description of the universe experiencing metric expansion of space. It uses the Balloon Analogy beyond its conventional breaking point, and then describes that conventional breaking point as the definition of "dimension". It then returns to the balloon analogy.

The new model of the universe is built on the conclusion that the Balloon Analogy is flawless if built using a scientific definition of "dimension". The conclusions include:

1. Our universe is the 3D surface of a 4D expanding hypersphere which exists in a 4D Reality.
2. Time is not the fourth dimension. Time dilation has a different explanation.
3. The expansion of the universe is caused by a force from outside our universe. Gravity is caused by that same force.
4. The surface "fabric" of the hypersphere acts as the medium of both massless particles and the wavelike properties of matter.

Logic and Mathematics

In the past the major revolutions in physics have been revealed by mathematical models. This theory is the opposite in that it came about through the realization that the mathematical models of the universe create a description of the universe with logical flaws and contradictions. Thus, those physicists who say, "Show me the math!" may lag in understanding behind the common layperson who seeks only to hold in their head a mental picture of the universe.

Trust in mathematics caused the logical problems which this theory solves. We as a species have endured a century of counterintuitive theoretical physics. That description of the universe was counterintuitive because it was illogical and incorrect.

Die-hard proponents of the Standard Model will argue that the Theory of Relativity has passed every test and its predictions are amazingly accurate so the model must be correct. To rebut that argument in advance, the mathematical model is the shadow cast by Physical Reality. Even if the shape of the shadow is understood, the shape of the thing casting the shadow could be far different from what is expected.

Red-Shift

Red-shift happens when the measured wavelength of a wave is longer than the wavelength of the wave when it was emitted. This can happen to all waves including sound and light.

The most common example of red-shift is cause by the Doppler Effect. The Doppler Effect is a change in the wavelength of a wave due to relative motion of the emission source relative to the observer. Red-shift is caused by relative motion of the emitter and observer away from each other because the wavelength appears longer to the observer. Blue-shift is the opposite.

Premise 1: Every time two objects are in relative motion away from each other, the Doppler Effect increases the wavelength observed by each object. If there is no Doppler Effect between two objects, then those objects are not moving toward or away from each other (and the velocity vector component on the line between the two objects is 0 (zero)).

Logic:

1. r (relative motion) IFF (if and only if) d (Doppler shift)

There are other forms of red-shift. These have nothing to do with motion. However, in any case of red-shift the Doppler Effect is considered first because it is most commone and easily understood.

Our Red-Shifted Universe

The universe is full of red-shifted objects. Every distant object is red-shifted. If an object is red-shifted, the first instinct of astronomers is to assume that the red-shift is due to the Doppler Effect and the object is in relative motion away from the astronomer. When astronomers first noticed that the entire universe is red-shifted, the natural implication was that the entire universe is moving away from the Milky Way Galaxy.

If the entire universe is in relative motion away from the Milky Way, then the Milky Way is the center of the universe. In that case the universe appears to be expanding like shrapnel from a hand grenade away from the center point which is essentially humanity. This would place humanity at the center of the universe.

However, scientists don't like this model of the universe because it violates the Copernican Principle which states that humans do not occupy a special place in the universe. This principle is more scientific faith than scientific fact, but the entire scientific community would be very uncomfortable if it were violated.

Premise 2: If the Universal Red-Shift is caused by relative motion (the Doppler Effect), then all the distant objects in the universe (outside the local galactic

supercluster) are moving away from the Milky Way galaxy and Earth is at the center of the Universe in violation of the Copernican Principle.

Logic:

2. If Ur (Universal relative motion) then ~ (not)c (Copernican Principle)

Metric Expansion of Space

Thankfully, for the sake of the Copernican Principle, an explanation for the Universal Red-Shift was found that did not involve the Doppler Effect, relative motion, and the violation of the Copernican Principle. That explanation was the metric expansion of space.

It was noticed that the distances between all objects in the universe were increasing, not just the distances between distant objects and the Milky Way. The conclusion was that the volume of the universe is increasing, everywhere, and that the distance between objects was increasing due to the increasing volume between those objects rather than any relative motion on the parts of those objects.

The Big Bang Theory took the idea that the volume of the universe is increasing and looked into the past. It the volume is increasing then the farther back we look, the lower the volume of the universe. If you carry this idea to its logical end, there is a point in time where the volume of the universe is zero. That moment is the Big Bang.

If the volume of the universe can change and was once much lower than it is today, then there was a time when there was no empty space and matter had no room to go anywhere because the space to move around simply did not exist. According to theory, there was a moment before which the universe was so hot that photons could not move freely through the universe without getting immediately absorbed, and after which the universe was transparent to photons. The photons existing at this moment would, according to theory, travel through the universe for the rest of time.

Those photons were found in the form of the Cosmic Microwave Background Radiation (CMBR) and that discovery was sufficient o confirm of the Big Bang Theory as scientific fact.

The Metric Expansion of Space explanation for the state of the universe explains the red-shift of all distant objects as a consequence of expanding space called Cosmological Red-Shift. According to this explanation, light from distant objects gets expanded as the universe expands.

Premise 3: The Cosmological Red-Shift explanation for the red-shift of distant objects means that no Doppler Effect is present and those distant objects are not in relative motion with respect to the Milky Way Galaxy. The Metric Expansion of Space theory leads to the Big Bang theory which removes the Doppler Effect from the model and preserves the Copernican Principle.

Logic:

3. If m (metric expansion of space) then ~d

4. m

Therefore:

5. ~d

6. ~r

7. ~(~c) [Technically the principle is not confirmed, only not proved false.]

Consequences of Rejecting the Doppler Effect

By discovering the Metric Expansion of Space and the Big Bang Theory, physicists saved the Copernican Principle and discovered that the universe had a beginning. The discovery of CMBR provided overwhelming supporting evidence for the expanding volume of space idea and today the idea that all distant objects are in motion away from the Milky Way Galaxy (at the center of the universe) seems absurd.

However, the implications of the rejection of the Doppler Effect as the explanation for the red-shift of distant objects have apparently not been fully explored.

Motionless Expansion

If there is no Doppler Effect involved with the red-shift of distant objects, then those objects have a relative velocity of zero with respect to the Milky Way (on the velocity vector component on the line passing through both objects). This means that, on a cosmological scale (the big picture) distant objects are at rest with respect to the Milky Way.

More specifically, the exclusion of relative motion from the explanation of the red-shift of distant objects implies that the cause of the expansion of the universe is unable to physically move matter.

To Doppler or Not to Doppler

All distant objects are red-shifted. The red-shift is the observation. The red-shift is the observed form of some effect and that effect is caused by something.

If the cause of red-shift is an explosion originating at the Milky Way Galaxy, then the effect is a universe full of objects in motion away from the Milky Way and the red-shift is just the observation of that motion via the Doppler Effect.

However, scientists have already ruled out the Doppler Effect. The implications are profound. This means that they have ruled out motion of any kind. In other words, the Cause of cosmological red-shift does not move objects.

If the Cause does not move objects, then it does not impart velocity, it does not accelerate matter, it does not exert a force, it does no work and no energy is involved in the process.

According to the Merriam-Webster Dictionary online, Physics is defined as:

"A science that deals with matter and energy and their interactions."

However, if exactly zero Doppler Effect is involved in the explanation for cosmological red-shift, then physics does not have the jurisdiction to try to explain it, because no matter or energy is involved.

It is said that the expansion of the universe is happening from the momentum from the Big Bang and inflation, but the expansion of the universe does not involve matter in motion so this is false.

It is said that gravity slows down the expansion of the universe, but gravity accelerates object causing them to move through space creating red and blue shifts depending on one's perspective due to the Doppler Effect. The cause of the expansion of the universe never accelerates matter, never creates a Doppler Effect, and instead creates space.

If the expansion of the universe creates space, then if gravity can oppose this expansion and create a "Big Crunch" (hypothetically if conditions were right) then gravity should be able to destroy volume reducing the volume of space in a space.

Gravity and the Cause of Expansion accomplish completely different mechanical tasks. These two effects cannot interact because gravity operates on matter and energy while the cause of expansion operates only on space.

Understanding Expansion through Models and Analogies

The first step to understanding the expansion of the universe is understanding that space cannot be defined by its volume. The core idea of the Big Bang Theory is that any given space is always changing in volume. When thinking about expansion one must define a space by defining its boundaries and then decrease the volume of that space going back in time and increase the volume of that space going forward in time.

The Pudding Principle

The universe appears to be isotropic and homogenous. The CMBR is isotropic meaning that as far back in time as we can possibly look, there is no direction of space that looks any different from any other direction. It appears homogenous because when the distant stars, galaxies, and superclusters are modeled the density and composition of our universe appears to be essentially the same in every volume of space.

Pudding is the perfect analogy for understanding the homogenous universe because every scoop of pudding is the same (from the same source) but if you look closely not every molecule is the same. There are many different ingredients to pudding, but from a sufficiently distant perspective (outside the pudding) it is revealed as homogenous.

The Pudding Principle: If the Universe is homogenous on the cosmological scale, then any given cubic volume of the universe of sufficient size is representative of the entire universe.

The Pudding Principle makes picturing the expansion of the universe fairly easy.

The Ancient Ice Cube Analogy

Inside the ice of Antarctica, choose one cube of ice arbitrarily. That Cube of ice has existed for centuries. The atoms of that ice are in constant random motion because the temperature is above absolute zero which means that the atoms have relative velocity with respect to each other. However, none of the atoms are *going anywhere.*

The universe is the same. The visible universe has around 10 million superclusters. Choose a cube of universe big enough to contain a thousand superclusters and define it based on its boundaries. Due to the effects of gravity the stars and galaxies within that cube are in motion, but from a cosmological perspective (looking at the cube) nothing is going anywhere. Every supercluster in that cube has occupied exactly that spot since the moments after the Big Bang.

If you plotted every supercluster in the cube on a coordinate system. The coordinates of the superclusters would never change looking forward or backwards in time. That cube has looked exactly the same from the moment of the Big Bang until now. Nothing has ever moved in any direction within that cube.

The universe is frozen. Nothing ever moves in any direction on a cosmic scale. The expansion of the universe involves the changing volume of space around static, motionless, matter.

The Coffee Cup Analogy

Imagine you have a cup of coffee (or if it is within your means, go get a cup of coffee) on your desk. Define the boundaries of your cup of coffee as the boundaries of your cup of coffee (as opposed to a specific volume of space.)

Now imagine that the coffee in your cup is all the matter in the Milky Way galaxy. According to the Big Bang theory, all the matter and energy in the Milky Way galaxy once fit into a volume the size of your cup.

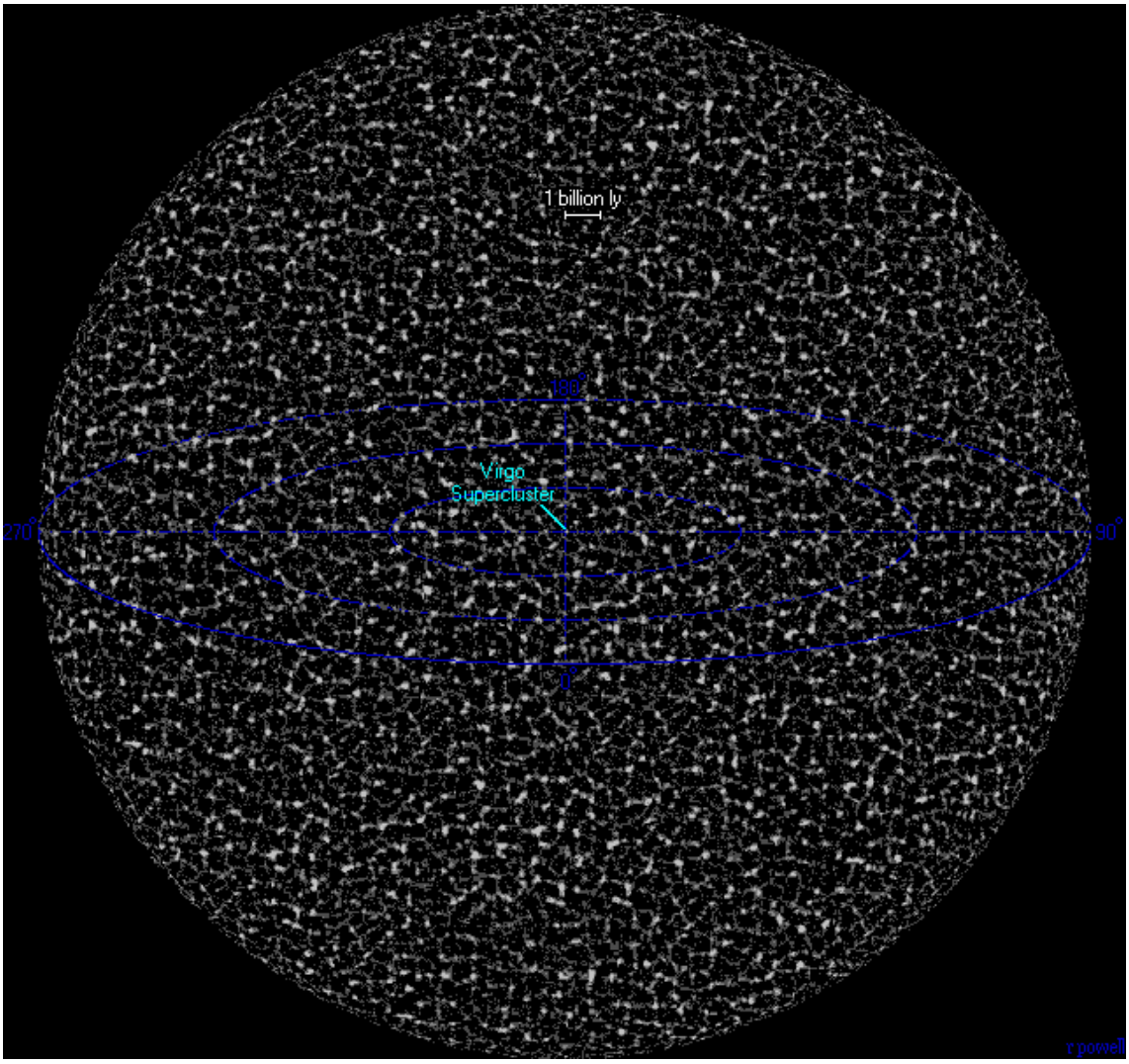
Now imagine the volume inside the cup increasing. Over time the pressure within the cup drops drastically as its volume increases. Eventually atoms have sufficient room to form and later the volume is large enough for nebulae, stars, and planets to form. Sometime after that the volume of space within your cup is 100,000 light years across and the galaxy is surrounded by empty space.

This is exactly the mechanism of the Big Bang. It seems absurd, but this is the mechanism of the standard model. Any given section of space once held far less volume than it currently does and will hold many more cubic parsecs than it currently holds. The volume of any arbitrarily chosen space is an ever changing value increasing over time. The volume of the universe is increasing.

What physical phenomenon can increase the volume within your coffee cup?

The Map Analogy

This is a picture of the visible universe today. The visible universe contains 10 million superclusters.



In the top middle region of the picture you can see a legend depicting a distance of one billion light years. If you could view this segment of space over the history of the universe, the center of gravity of each supercluster would never move. The two things that would change would be the distance depicted by that line and the amount of black space.

According to the Big Bang theory, the universe once looked nearly identical to this picture except the length of that line was one light year. Before that, the distance depicted by that line was one kilometer. The volume of the sphere changes, but the relative positions of the superclusters never change because the expansion of the universe does not involve matter in motion.

If you hold the picture of the universe at this scale, the second thing you would see is matter *moving* out of regions of space to maintain their orbits around a center of gravity. This

motion is caused by gravitationally bound systems and this *motion* creates the dark portions of this picture.

Motion is emphasized because it is completely ignored by the standard model due to the reliance of modern physics on mathematical models and the contradictions these models are based upon. The standard model implies that "dark energy" is responsible for the present rate of the expansion of the universe even though no energy is involved and not a single atom of matter has ever moved one nanometer in any direction due to the influence of the expansion of the universe. From the cosmological perspective, the universe is static and this is the only perspective that it accurate with regard to matter in the universe.

In contrast, from the cosmological perspective gravitationally bound systems are bound by motion. From that perspective matter is constantly moving toward the center of gravity of any gravitationally bound system. However, physicists normally use coordinate systems which do not account for the creation of volume in the universe to depict individual gravitationally bound systems and this is incorrect.

If you placed a supercluster inside a cube of space, the volume of that cube occupied by that supercluster would constantly shrink as the galaxies on the edge of the supercluster moved toward the center of gravity.

Scientists call the static picture of the universe with a variable scale the co-moving frame. This frame correctly depicts the universe as having static matter in a variable volume. This is the only correct framework for understanding motion in the universe.

Metric Contraction of Matter Analogy

Again consider the space defined as containing 1000 superclusters. From the cosmological perspective (distant and free to move around in time) the volume of space occupied by matter (in the form of superclusters) as a proportion of the total volume of the space is constantly shrinking.

In other words, from the cosmological perspective matter appears to be shrinking.

Imagine yourself weightless in a cubic room surrounded by your friends. Then everyone starts to shrink. Soon you are alone. No one has moved. No Doppler Effect has been registered. You began one meter away from your nearest friend, and an external observer would still measure you at that distance. Your coordinate within the room has not changed.

However, now you are one nanometer tall and still shrinking.

This is exactly what the expansion of the universe looks like. Once there was no empty space in the universe and the matter of the Milky Way Galaxy was smashed up against the matter from the next galaxy over. Now the galaxy sits alone surrounded by distant galaxies in a supercluster that will forever recede from the rest of the superclusters in the galaxy. None of this involves matter in motion. Everything is caused by the apparent shrinking of matter.

If you and your friend are not moving but the number of ruler lengths between you and your friend is increasing, your ruler is shrinking. No one says matter is shrinking, but the visual effect is identical.

The Balloon Analogy

There are many analogies that have been used to describe the expansion of the universe. The main three are the rubber band, rising raisin bread, and balloon analogies. The rubber band analogy is just a variant of the balloon analogy and the rising raisin bread analogy is flawed because it depicts motion. The balloon analogy is perfection.

The distance between every supercluster and every other supercluster in the universe is increasing. This is a very strange thing. If the distance between you and the thing in front of you is increasing, then the distance between you and the thing behind you should be decreasing. However, objects in the universe are moving away from everything and toward nothing. This is a difficult thing to explain.

The balloon analogy helps. If you draw dots on the surface of a balloon and then expand the balloon, those dots get farther apart. The area of the surface of the balloon increases increasing the distance between the dots without actually moving the dots themselves meaning that the relative positions of the dots never change even though the distances between the dots increase.

Additionally, if you draw a wave on the balloon that wave increases in wavelength as the balloon expands demonstrating the theorized mechanism for cosmological red-shift.

The dots on the surface of an expanding balloon are in motion. However, in this analogy the surface of the balloon represents the universe. The two spatial dimensions of the surface of the balloon represent the three spatial dimensions of our universe. If you draw a coordinate system on the surface of the balloon, the dots never change their coordinates and remain static in all the dimensions that are relative to the model.

However, if you fully apply the balloon analogy the conclusion is that our universe exists on the three dimensional surface of a four dimensional expanding hypersphere. If this is the case then the expansion of the universe does in fact move matter but that motion is in the direction perpendicular to the universe and thus the matter in our universe never moves in any of the directions used in a conventional coordinate system.

Is that the case? The short answer is “YES”. That is in fact the model proposed in this paper. The universe is the surface of an expanding hypersphere embedded in a four dimensional space.

However, a physicist supporting the standard model would oppose this hypothesis. They would say that the balloon analogy has limitations. Here is another website complaining about the limitations of the balloon analogy. The problem is that the balloon analogy is a representation of the three dimensional space of the universe using only the two dimensions of the surface of the balloon. Then the opposition to the analogy gets a little confusing.

The reason for this confusion is that the standard model lack the vocabulary to talk about the balloon analogy. This is the core flaw of Einstein's Theory of Relativity. Einstein never defined the term "Dimension" in physical terms.

"The balloon analogy depicts the three dimensional universe using the two dimensions of the surface of the balloon."

The term "dimension" as it is used in the quoted sentence, has no definition in physics. The book Flatland describes in great detail the meaning of the word "dimension" without ever defining the term.

The Definition of "Dimension"

The term "dimension" is fairly easy to define in physical terms. Most people who have read Flatland or who have given much thought to the subject of dimensions have a good grasp of that the term means.

The difficulty lies in the fact that there is no way to define the term "dimension" in physical terms in a way that allows non-spatial dimensions to exist.

A dimension is a type of direction in space such that all directions of this type point away from all other directions of this type. In other words, all dimensions are directions that are perpendicular to each other. The number of dimensions possible in a given space is a property or characteristic of that space. The number of directions of extension of an object is the dimensional property of that object.

In all cases, dimensions in physical reality are spatial dimensions and non-spatial dimensions are relegated to the realm of mathematics.

The reason for the confusion is that, unlike most terms which originate in physical descriptive language, the term "dimension" originated in mathematical language and was brought into physics without translation.

Thus, until academic physics accepts a physical definition of the term "dimension" it cannot begin to contemplate any concept which involves the concept of dimension including the balloon analogy.

Additionally, time cannot be the fourth dimension or indeed any dimension of our physical Reality because time is a non-spatial dimension that can only exist in mathematics.

Granted, standard model uses a coordinate system with time as one of the dimensions. Furthermore, that model works well. However, even though the model has great predictive power it does not accurately describe physical reality because time cannot be a dimension.

Once the concept of *Time as the Fourth Dimension* is abandoned the universe makes a lot more sense.

4D Balloon Theory

The universe is a three dimensional space. There are three spatial dimensions to our universe. Time is not a dimension even though the math works. Time dilation will be discussed later in the paper.

4D Balloon Theory Hypothesis

The 4D Balloon Theory hypothesis goes as follows: The universe is the three dimensional surface of an expanding four dimensional expanding hypersphere embedded in four dimensional space. The three dimensional volume of our universe is modeled as the two dimensional surface of in the balloon analogy.

If a four dimensional reality exists, then our universe cannot exist independently and must exist on the surface of an object. Otherwise matter in our universe would have four dimensions of freedom of motion. The thing that can constrain particles of 4D matter to three dimensions is the surface of a 4D object.

Furthermore, the surface of the 4D object can bend and stretch just like the surface of a balloon. This is the case in our universe as we have discovered that the presence of matter creates a dent in space. This dent is in a direction perpendicular to our universe. Additionally, if matter dents the surface of a 4D object then the matter must be four dimensional.

We know the universe the universe exists on the surface of an expanding object because the volume of the universe is increasing.

The expanding object is a hypersphere because if the universe had any other shape the CMBR would not be isotropic and there would be some direction that would appear different from another direction.

In short, the 4D Balloon Theory hypothesizes that the expanding balloon analogy is a perfect analogy.

The value of this theory lies in its explanatory power and the way it eliminates counterintuitive premises. There are three main consequences of 4D Balloon Theory (4DBT) which deliver intuitive understanding of the universe while clearing away cognitive dissonance in the form of illogical, confusing, and contradictory conclusions.

1. External Forces: There are external forces acting on our universe.

2. Aether: Einstein believed in an aether. This paper agrees with Einstein and that aether is the surface of the universe.

3. Time: Time dilation and the apparent time dimension can be explained using the external forces mentioned in point 1.

External Forces

In every analogy offered in the Motionless Expansion section, all matter was motionless and the volume of space around matter increased over time. However, in the balloon analogy,

matter is in motion away from the center of the balloon. However, the only part of the balloon that represents our universe is the surface. The interior of the balloon is four dimensional space and the space outside the balloon is the same. The universe is only the surface of this object.

If you put a coordinate system on the balloon, that would represent all the spatial direction in our universe. The direction away from the surface of the balloon represents the fourth dimension pointing in the direction away from our universe.

The Out-Force

The universe is expanding. That means the hypersphere on which our universe resides is increasing in size, the surface volume of the 4D hypersphere is increasing, and the surface is *moving* in the direction away from the center of the sphere. This means that matter, on the surface of the object, is moving. However, that motion is in the direction perpendicular to the natural lay of our universe.

The natural lay of the universe is a hypersphere where the surface is always perpendicular to the direction of motion.

The surface is not only moving, it is accelerating. We know this because matter puts a dent in the surface of the universe proportional in depth to its mass. Furthermore, once a dent is made and the matter moves on, the dent is removed. This indicates that the dent is caused by inertia or an equal and opposite reaction. The only way to create dents in a surface proportional to the mass on the surface is to accelerate the surface. For example, a marble and a lead ball will create dents of differing depth in a rubber mat while subjected to gravity. The way to recreate this effect without gravity is to accelerate the rubber mat.

The force accelerating the surface of the object away from the center of the object points out away from the center which is why it is named the Out-Force. The outforce comes from within the object and acts only upon the surface inner of the object. In the same way, air within a balloon operates only on the inner surface of the balloon and never touches objects on its surface.

It should be fairly easy to calculate the acceleration of the universe in the Out direction. It should also be fairly easy to calculate the tension of the surface. Both of these calculations will involve the In-Force.

The In-Force

There is a force acting upon the inner surface of the universe propelling it outward away from the center of the object. The surface of the object then acts upon mass propelling it in the same direction. Newton's third law states that for every action there is an equal and opposite reaction. In the case of the universe, as the outforce acts upon the surface which then acts upon matter, matter acts upon the surface in return creating a dent.

The inforce points toward the center of the hypersphere at all times.

The force of matter upon the surface is equal to the mass of the matter times the acceleration caused by the outforce. That is what makes a dent in the surface of the object. That force is equal to the tension in the surface.

Gravity

Force is mass times acceleration. Where there is a force there will be acceleration. However, the expansion of the universe is without acceleration. That is because we can only measure velocity in the directions of our universe and the direction of expansion is away from our universe. This means that expansion never moves objects in any direction on a cosmological scale because from the cosmological scale all objects are pushed in the direction perpendicular to the natural lay of the surface.

However, matter creates dents in the surface. As soon as the surface is dented there is some component of the vector of the inforce that points in the direction of our universe. Furthermore, this component of the inforce always points toward the center of the dent.

In other words, gravity is the component of the vector of the inforce that points in the direction of our universe at any given point.

Summary

There is a force that acts upon the surface of the hypersphere upon which our universe rests propelling the surface outward away from the center of the hypersphere in a direction perpendicular to the universe creating an "Out-Force." To be clear, this is a force from outside our universe acting upon our universe.

The equal and opposite reaction to the outforce creates an "In-Force" which acts upon matter to create a dent in the surface of the hypersphere. Objects in the dented region experience the component of the inforce that point in the direction of our universe as an actual force and this force is gravity.

Gravity is not a field. Rather, gravity is the equal and opposite reaction to the expansion of the universe. Gravity is a consequence of a force acting upon our universe from outside our universe.

Aether

The surface of the 4D hypersphere exists at every point in our universe creating a physical connection between every object in the universe. There is no action at a distance. There is only action through the surface of the hypersphere.

The surface of the hypersphere is the medium of light and all other massless particles. The surface of the hypersphere serves the same purpose as the luminiferous aether. Einstein's theory of relativity seemed to eliminate the need for an aether, but he did not believe that and invented a "relativistic aether" to serve the function of luminiferous aether. He was ignored in this endeavor.

4D Balloon Theory (4DBT) revives the concept of aether because the surface of the object is so obviously that. This is the realm of quantum mechanics. There are always vibrations in the surface and sometimes they combine to create a particle.

String Theory

String theory, as a description of physical reality, is completely false. It is based on one dimensional strings which reveals a complete lack of understanding of the term "dimension." The only reason people believe in string theory is because the math works in ways that are hard to believe are coincidental. This last aspect of string theory has great potential.

According to 4DBT, wave-like properties of massless and massive particles alike happen in the surface of the universe.

What mathematical model describes a wave in the three dimensional surface of a four dimensional hypersphere? I hypothesize that the mathematical model of string theory does that quite nicely. I suspect that string theory mathematics, with the meanings of some variables changed, will be the key to the mathematical model for the descriptive model described in this paper.

If so, string theory happens in the surface of the universe which is the aether. It is a physical thing with no magical properties like the surface of a balloon.

Time

Time is not the fourth dimension of the universe. Time is used as the fourth dimension of a coordinate system used by mathematical physicists to model events in the universe and there is nothing wrong with that as long as the model works.

However, even if the math works, time is not the fourth dimension because a dimension in physical reality is a direction. Time is not a direction any more than hardness, heat, or the 1 – 10 attractiveness scale and those can all be used as dimensions in certain mathematical contexts.

In physical reality, only spatial dimensions are dimensions.

What then is time? Time is measurable periodic motion. The swing of a pendulum gives a unit of time. The orbit of the Earth around the sun gives a year and a rotation of the Earth on its axis gives a day. Seconds, minutes, hours, and fortnights are all measured by counting periodic motions of physical objects.

Those periodic motions can be influenced.

Time dilation happens when time in one place or under one circumstance seems to pass at a different compared to time at a different place. However, this has nothing to do with the "time dimension" and can by explained through physical processes.

The speed of time decreases as gravity increases. More specifically, the length of a unit of time increases as gravity increases. In other words, on the surface of the Earth seconds are longer than seconds on a satellite orbiting Earth so for every second that passes on the orbiting satellite, slightly less than a second has passed on the surface.

The reason is simple. Gravity is the consequence of a dent in the surface of the hypersphere. That dent not only changes the angle of the universe with respect to the inforce (creating gravity), it also increases the volume of the space in that dent.

Consider a region on the surface of a balloon that is a square 10 units by 10 units. You pick the units. If you press your finger into the middle of that square making a dent, the surface area of that square goes from being 100 square units to more than 100 square units. In other words, the act of denting space increases the volume of space creating a local metric expansion of space everywhere there is gravity.

In a region of local metric expansion of space, time will appear slower because time is a function of an absurd number of light speed interactions within atoms and elementary particles. If the speed of light remains constant but the distance increases slightly, then the time needed for the light speed interactions will increase in proportion to the increased distance for each interaction.

In other words, the metric expansion of space due to denting the hypercube results in a metric expansion of objects within that space. If you increase the size of the clock you decrease the speed of time measured by that clock.

This explanation only addresses time dilation due to gravity. Does acceleration create a local metric expansion of space? I don't know. There is much work to be done.

Also of consequence is the fact that the metric expansion of space due to the expansion of the universe might cause partial metric expansion of matter. If this is the case all of our calculations involving time could be way off and the universe could be far larger and far older than we imagine.

Additionally, if the speed of light is proportional to the tension in the surface of the hypercube, then that tension could be increasing over time the way the tension in the surface of a balloon increases as it is filled up with air.

The matter of time, metric expansion of space, and metric expansion of matter is a mathematical quagmire of possibility with no clear logical solution at this time.

Summary

Einstein's Theory of Relativity was a brilliant mathematical work and this 4D Balloon Theory completes his work by correcting the mistake with the term "dimension".

The four dimensional model of the universe places our universe on the surface of a four dimensional object embedded in a greater four dimensional reality. Our universe is expanding in a direction perpendicular to the universe due to a force from outside the universe and gravity is the consequence of that force.

The three dimensional surface of the four dimensional object is a physical thing which is present everywhere in our universe and is the medium through which all massless particles travel

and is the cause of the wave-like properties of matter. The mathematical models of string theory may hold the key to understanding particles as waves in the surface of a four dimensional object.

Finally, time is not a dimension in physical reality because non-spatial dimensions cannot fit any physically descriptive definition of the term “dimension” and a physical explanation for time dilation is needed (and at least partially found.)

There is no longer an excuse for non-intuitive descriptions of the universe. All physical phenomena can by intuitively understood once the universe is framed in the context of a greater four dimensional reality. The idea of an external universe or an extra-universal force acting upon the universe might not be pleasant, but it can’t be helped.

In the context of four dimensional reality, our universe seems utterly trivial.

Appendices

The appendices are reserved for in-depth discussions of elementary physics concepts that some will need explained or reminded.

Vector

A vector is an especially accurate way of describing direction. Once a frame of reference is defined then there will be a vector component for each dimension possible within a space. For example, in a normal graph of the form $y = mx + b$, m denotes the rise over run or vertical component over horizontal component.

In our universe a velocity vector can only have three vector components corresponding to the three dimensions of our universe. However, by understanding that there is a fourth vector component much of modern physics that now seems opaque will hopefully become intuitive.

References

In theory I should use references. Hopefully I can find an assistant before this section has to be filled out.