Universe Design 2013 (UD13.2)

VERSION 2.0

SEO: Theory of Everything, Model of Everything, Universe Simulation, Matter from Energy and What is Inside a Black Hole

By Laurence G. Hassebrook

Table 1: Updates, edits and additions.

<table>
<thead>
<tr>
<th>Date</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>6-11-2015</td>
<td>Creation of (N-1)-Dimensional Universes using Black Holes</td>
</tr>
<tr>
<td>6-11-2015</td>
<td>Added Nested Multi-verse model.</td>
</tr>
<tr>
<td>4-14-2014</td>
<td>Stopped updating Version 1.0</td>
</tr>
<tr>
<td>4-21-2013</td>
<td>Initialized description of UD13</td>
</tr>
</tbody>
</table>

Table of Contents

SEO: Theory of Everything, Model of Everything, Universe Simulation, Matter from Energy and What is Inside a Black Hole ........................................................................................................... 1
Acronyms ...................................................................................................................................................... 2
Preface .......................................................................................................................................................... 2
1. SPRING MODEL CONCEPT .......................................................................................................................... 3
   1.1 Introduction ........................................................................................................................................ 3
   1.2 Big Fantastic Spring (BFS) and Matter Bubbles ................................................................................. 4
   1.3 Big Fantastic Force Fields (BFFF) ...................................................................................................... 7
   1.4 Motion of Matter Bubbles, Time and Massless Inertia ........................................................................ 8
   1.5 Light = 1 Bubble + 1 Anti-bubble + BFS Wave .................................................................................. 8
   1.6 BFS Gravity and Distance .................................................................................................................. 9
   1.7 Stochastic Motion of Really Small Particles ...................................................................................... 10
   1.8 Hypertoroidal Shaped Bubbles .......................................................................................................... 10
   1.9 Dark Matter, Dark Energy or Dark Foam? .......................................................................................... 11
2.0 Matter from Energy: How bubbles form? ................................................................................................. 13
   2.1 Anatomy of a Black Hole: Formation of the Big Fantastic Black Hole ................................................. 13
Preface

The Universe Design represents a convergence of two trains of thought, one thought is the use of spring models for a variety of applications and the other is an interest I have had in physics. My group has been working on spring models over the years with limited sporadic progress. We have tried several applications where I think the most interesting has been using the nodes of a spring mesh as a swarm and the mesh as a constraint system to keep the swarm organized. That said, this type of swarm mesh can be used to track 3-D data such as facial expressions and in so doing keep track of specific facial features. Other applications of springs include morphing from one shape to another while preserving various features. Probably most of our progress has been in flattening 3-D fingerprints. The second train of thought has been a hobby of mine and that is physics. I recall thinking about how forces have to alternate between attraction and repulsion; else matter would combine and hence never be separate in the first place. And in fact, that maybe if it is possible to compress these forces enough they would lock space into something else, possibly matter. Taking that simple heuristic observation and applying on an astrological scale, then galaxies may actually repulse each other if they get too far away. A few years later I heard about dark energy. Of course, dark energy is a better explanation of expansion but the similarity between the two ideas certainly spiked my attention. A few years ago I read the Black Hole War by Leonard Susskin. In the book, Susskin gives a concise summary of physics and I thought to myself, “I could model that” and most of the model could fit into a spring like framework. More recently, there has been a surge of astro-/quantum physics documentaries on the science channel.
So I continued to think through my spring model of the universe. At first I was going to just do a Newtonian spring model but then I realized if matter was the bubbles in a 4-D spring space and that space had no frictional losses and no damping coefficients then the bubbles would increase in size as their velocity increased. Hence, bubble mass increases with relative motion and hence having a relativistic characteristic. Furthermore, on the smallest scale of matter, the smallest bubble particles could be vibrated in the 4th dimension and hence their force projection onto our 3-D space would vary and even seem to disappear. This aspect is a foot in the door of a stochastic particle model. The model could be represented in 1-D and 2-D spaces for numerical computation and allow certain experiments to be conducted to evaluate the details of the model and develop the software and algorithms needed to support the spring models.

1. SPRING MODEL CONCEPT

While reading the Black Hole War by Leonard Susskin I felt I could make a pretty good numerical universe model, albeit a “customized” synthetic universe rather than trying to fit the existing physics exactly. It became apparent that a spring model would work pretty well and contribute to the needs of my day job in terms of spring algorithms. The obvious name for this non-theory was “spring model.” Universe Design 2013 (UD13) is defined by the Spring Model.

1.1 Introduction

Universes Design 2013 (UD13) is an engineering design problem of a synthetic universe and is not a scientific theory. UD13 consists of a 3-Dimensional infinitely Big Fantastic Spring (BFS) compressed between two 4-Dimensional infinitely Big Fantastic Force Fields (BFFF or BF³) having opposite charge. The compression is along the 4th spatial dimension. This pattern is repeated along the 4th dimension to form a Big Fantastic Multi-verse (BFM) (i.e., ..., +BF³, BFS, -BF³, BFS, +BF³, ...). For visualization and numerical efficiency, lower dimensional versions of single and multi-verse models are used. For example, if we represent a 3-D BFS as a 1-D line then the BFFFs are 2-D areas. Likewise, if we represent the 3-D BFS as a 2-D manifold then the BFFFs are 3-D volumes. See Fig. 1.1 for basic representation. Representing 3-D BFS in 3-D is more complicated but can be done by forming 3-D projections into the 3-D. For example, the force field projection versus the actual bubble size of a particle in 3-D BFS may be represented with concentric transparent spheroids.
1.2 Big Fantastic Spring (BFS) and Matter Bubbles

The BFS is a zero viscosity, zero loss 3-Dimensional spring. As far as I can tell, the BFS is not an “ether” model and reference frames work pretty much the same as in relativity. But space is not “nothing.” Space is a “thing” with characteristics. Matter has a 4-D motion vector (small particles can move easily in the 4th dimension) where each orthogonal vector component can correspond to a different reference frame. Matter is formed by “pinching” the BFS into one or both of the BFFF 4-D spaces to form “bubbles” which project charge force onto the 3-D BFS as well as forces between bubble boundaries within the BFFF 4-D spaces. The bubbles are connected to the BFS via an inversion point. What we “see” as matter is primarily the projection of the bubbles onto the 3-D BFS and the interaction of the bubbles is primarily within the 4-D BFFF spaces. A 1-D model of the BFS and 2-D model of BFFF with a quantum bubble is shown in Fig. 1.2. For simplicity, we represent a bubble as a circle as shown in the left bubble of Fig. 1.2. When including the forces between the BFFFs, and the tension of the BFS bubble boundary, the bubble may be distorted to look more like Fig. 1.2 (right). Where the bubble boundary folds onto itself is the inversion point. If we assume our matter exists in the +BFFF space then matter in the –BFFF space would be anti-matter. What is different about anti-matter collisions with regular matter is that regular matter bubbles collide within the +BFFF space which means they reflect unless their collision force is so large as to fuse or divide their bubbles. Anti-matter does not collide with regular matter and so it can occupy the same BFS position without collision. The stress under this condition at the inversion points “implodes” the two bubbles bringing their +BFFF and –BFFF together which results in a sudden relaxation of BFS space and also creates more BFS until the +BFFF and –BFFF are separated again. The boundary between different polarity force fields is assumed infinitely thin but if it were real, would there be a thickness? Maybe a quantum thickness? Particle entanglement is also a bit of a mystery? That is, could two particles be coupled in some way independent of 3-D or 4-D distance? One thought is that two
bubbles could be formed with initial angular velocity that forms an oscillating vortex in the spring structure that would connect the two bubbles. A vortex in a BFS may have some interesting characteristics. Would it oscillate? Or would it just keep twisting since it would be twisting about 0 radius, the vortex would not exert any forces or even be detectable as a vortex? On the other hand, if it did have a radius, no matter how small, the force of the vertex would expand out and hence eventually oscillate. So what happens if two bubbles oscillating with a vortex connecting them, move apart? Is the vortex stable?

**Figure 1.2** (left) Ideal circular quantum bubble. (right) Bubble distorted by BFFFs.

The quantum bubbles can be formed together to make more complicated particles. In Fig. 1.3 we show particles formed from double quantum bubbles. A single quantum bubble along with its anti-bubble forms the particle component of light in UD13. The double bubbles shown in Fig. 1.3 include bubbles on or in bubbles.
Figure 1.3: (top) Quantum bubbles and their combination into a photon particle. (bottom) Double bubble combinations to make different primitive particles.

Not shown in Fig. 1.3 is that given a bubble is in a +BFFF, bubbles entrapping –BFFF will be larger than bubbles entrapping the same +BFFF. Why? As shown in Fig. 1.4, the attraction force between the +BFFF and –BFFF (inside the bubble) causes a non-uniform distribution of –BFFF. The –BFFF will be denser near the inside of the bubble shell. The lateral opposing force of the –BFFF space will increase the bubble surface area and hence the bubble containing –BFFF will be bigger than the bubble containing +BFFF given both are in the +BFFF space. The reverse is true in the –BFFF space. Hence, the two bubbles will have the same “charge” but different sizes. Extrapolating this to clusters of bubbles, we have a plausible explanation for the size difference between electrons and protons and their near equality in charge amplitude.
1.3 Big Fantastic Force Fields (BFFF)

In UD13 the BFS is trapped between two oppositely charged BFFFs. The term “charge” indicates that a +BFFF has a force attracting the –BFFF. At the same time, bounded +BFFF or –BFFF repel BFFFs of the same “charge.” The idea for UD13 is that when + and – BFFFs come into contact with each other, the result is the neutral 3-D BFS is created and thereby separates the two BFFFs. Hence, the 3-D space is the boundary along the 4th spatial dimension between the BFFFs. In the case of bubbles, the BFS again forms a separation boundary. If there are no vibration or mass bubbles in a BFS, then the attractive force field between the + and – BFFF passes through the BFS parallel to the 4th dimension and thus orthogonal to the BFS 3-D space. Hence, the force is not detected but it does contribute a compression factor to the BFS. If vibrations exist in the BFS then BFFF passes through the BFS in detectable non-orthogonal directions. For a traveling transversal waves in the BFS, the BFFF’s effect oscillates and contributes to the wave in a sinusoidal oscillation. The hope here is that this can be related to the E and B fields in an electromagnetic wave but as of this writing, this aspect has not be developed. When I first started designing the BFFF, I considered a spring model similar to the BFS. However, this would present issues in the movement of the bubbles. So a more practical model would be one that does not have a spring structure but does share some of the

Figure 1.4: Bubbles of opposite charge to their resident BFFF are enlarged.
characteristics. The best analogy is a “gas” model. This allows for a dynamic spring model to be used but allows bubbles to move around independently.

1.4 Motion of Matter Bubbles, Time and Massless Inertia
Matter is in the form of a bubbles containing one charge of BFFF inside and surrounded by the opposite BFFF charge. To simplify discussion we will talk about mass as a single bubble but for there to be what we normally call mass or matter, the bubbles need to be clusters of more than one bubble. All bubble boundaries are clamped between opposite charged BFFF spaces along the 4th spatial dimension. Time and inertia are defined slightly different in UD13 than a real universe. Time is strictly based on cause and effect. A normalized time measure is based on some cyclic aspect of the UD13 components. Inertia is a geometric trajectory of the BFS bubble surfaces within the BFFF spaces. The result is that as bubbles move, the BFS does not and the bubble undergoes a geometric form of centripetal force. So as the bubble increases in speed, its size increases along the direction of movement. Hence, a bubbles “mass” which is the bubble diameter, increases with velocity. Hence bubble mass is relative and depends on the reference frame or relative velocity of the mass bubbles. As the velocity approaches the speed of light, the size of the bubbles increases and cannot exceed the speed of “light” without requiring infinite force.

1.5 Light = 1 Bubble + 1 Anti-bubble + BFS Wave
In UD13, light or electromagnetic waves have three components. UD13 is not eloquent in that its equations or laws do not hold at the extremes. One extreme that does not hold is for single bubbles. Matter is made from a complex of bubbles but light has two bubbles as its particle component. The bubbles are locked together as shown in Fig. 1.5, one in +BFFF space and the other in –BFFF space and hence 0 charge. Let’s call these bubbles the positive photon bubble and negative photon bubble (i.e., anti-bubble) which comprise a single photon particle. The photon bubbles do not destroy each other like matter and anti-matter because the charge forces are not large enough to overtake the effective centripetal force (velocity = c) and the crossing point forces. The BFS vibrates with waves that travel at the speed of light. These waves alone are electromagnetic waves as well as gravitational waves or vibrations. The waves capture photon bubble pairs which can travel with the waves at the speed of light. Unlike bubble complexes, single bubbles are too small for significant centripetal force and do not change significantly in size with velocity and hence they are captured by BFS waves and form light particles/waves. The first big question is will the inertial force from cause and effect changes in bubble position plus the change in charge forces be strong enough to allow the BFS waves to move the bubbles to the speed of the waves? How would we calibrate the centripetal and inertial and spring forces? I am thinking that if we use the numbers associated with the highest energy photons, say gamma rays, that we can determine the relative ratio between the bubble diameters at the speed of light that would still fit within the waves of the gamma ray frequency. This calibration is a keystone of the spring model because it basically sets the quantum scale parameters between gravitational wave magnitudes and the photon radius at the speed of light.
1.6 BFS Gravity and Distance
Gravity is simply the spring forces within the BFS. Matter bubbles stretch the BFS in local areas. The forces from these matter points spread through the BFS and defuse by \(1/r^2\). When matter bubbles are near each other and do not have large differences in velocity or charge, gravity will bring them together to relax the BFS. That is the gravitational force. We can graphically see how this works in Fig. 1.6. In the upper left and upper right quadrants of Fig. 1.6 we have the same BFS space but the left one with a Mass A bubble and the right one with the Mass B bubble. The BFS in Fig. 1.6 is modeled as 2-Dimensional and the dashed lines around the inversion points are the projection of the bubbles onto the 2-D space. The large colored arrows indicate the force vectors. The inversion points apply the most forces to the BFS and are at equilibrium within the BFS. With distance from the inversion point, the forces distribute throughout the BFS and decrease with distance from the inversion points. Separately, the Mass A and Mass B are in force equilibrium and will not move. In the lower left quadrant of Fig. 1.6, we sum the force contributions from both Mass A and Mass B. To determine the motion of the bubble masses, we are only interested on the force summation at the inversion points. In the lower right quadrant, the resulting forces show that the inversion points will effectively move toward each other. If we ignored the bubble interference, equilibrium would be reached when the inversion points occupy the same position and trajectory.
1.7 Stochastic Motion of Really Small Particles

Really small particles are bubble complexes that are not just moved around at sub-light speed by being nudged by BFS waves or other particles but also vibrated orthogonal to the BFS-BFFF interface (4th spatial dimension) and hence their force and interference projection onto the 3-D BFS comes and goes randomly.

1.8 Hypertoroidal Shaped Bubbles

Let us consider a stable bubble shape other than spherical. This is best visualized in a 2-D representation of the BFS where the BFFF is 3-D. In such a space the BFS is a 2-D plane and a spherical bubble is just that, a spherical bubble attached to the plane by its inversion point. The bubble can move anywhere in the plane as well as “bounce” with the BFS waves in the 3rd dimension contained in the BFFF. The BFFF force projection onto the BFS plane is the matter representation of the bubble inside the BFS. Now consider the formation of shapes other than spherical bubbles. Consider BFS waves crashing together with enough force to invert into a cylinder shape or what I will call a 3-D “hot dog” bubble manifold. The inversion point is now an inversion line joining the hot dog manifold, contained completely in the BFFF, to the BFS.
My estimate is that the hot dog shape is not stable and the BFS forces would pull and push it into a spherical bubble such that the inversion line would converge to a stable inversion point. Assuming inversion points leak until a quantum radius is achieved, the hot dog would also converge to a quantum bubble. Now consider the BFS waves crashing together from all directions equally and forming a toroidal manifold where the inversion is a circle in the 2-D BFS. This manifold is stable and would converge to a quantum toroid of a given radius. There is more that we can make with a toroid. Imaging it worked out that there is a spherical bubble formed or trapped in the “donut hole” of the toroid. Both torus and bubble would trap the same charge of BFFF and so they would repel each other. This would squish them both deeper into the 3rd dimension of the BFFF and enlarge the radius of the torus. The projected matter into the BFS would be a circle formed from the center bubble surrounded by a ring formed by the torus. Now let’s complicate it even more. Create another torus outside the first and put more bubbles in the center donut hole, as well as on the toroid’s surface, and as well as between the adjacent toroids. The bubbles would move around on the surfaces and between the toroids. Bubbles would tend to either on a specific toroid or between toroids but not move outside these bounds. The projected matter in the BFS would look very much like an atom with quantum shells containing moving particles. One of the things that worries me about just using spherical bubbles to create particles is the big difference in size between an electron and a proton. It would take a lot of bubbles to make a proton and hence there would most likely be a huge number of proton or neutron variants. But with shapes like a torus, the construction simplifies and we start to get shapes that not only could represent bigger particles but could also lead to the quantum shells or valence bands. At this writing, I am not sure if a hypertoroid is the desired shape in a 3-D BFS model but I would look for a shape whose inversion manifold is spherical in nature such that the bubbles can be constructed to yield concentric spherical projections within the 3-D BFS. Some simple experiments or coming across the right publication would probably answer this question. Most of what I have seen in terms of hypertoroids has not included the inversion constraint so it is difficult to evaluate what the projection into a 3-D BFS would be.

1.9 Dark Matter, Dark Energy or Dark Foam?

In the UD13 there is a simple explanation for Dark Matter and Dark Energy. They are both the same “thing” which we will call Dark Foam (note that “Dark Foam” is not the same idea/thing as “Quantum foam”). In section 1.6 we assumed that the positive and negative photon particles are traveling together at the speed of light. What if they are not? Although it is a slightly flawed analogy, consider a surfer and his/her surf board out on the ocean. When they are near shore the waves change characteristics and form distinct traveling waves and when combined with gravity, the surfer can ride these traveling waves as long as they last. But imagine our surfer is out in the middle of the ocean, where there are a lot of waves but for the most part they are not “traveling” or distinct. These waves are interference waves. The surfer can travel with each wave for a short time until it “disappears” and a new wave that is traveling in a different direction “appears” at the same location. The surfer basically will surf at the speed of the waves but constantly change direction and depending on the statistics will at best travel very slowly in one direction via Brownian motion. Now, let’s say the interference waves decrease in amplitude while the surfer is in the middle of the ocean. At some point the surface will no longer be able to travel at the same speed as the wave and just wiggle around at sub-wave speed.
So how does this relate to what dark foam is? I will define dark foam as the collection of the photon particle pairs. Within a galaxy, there are photon pairs generated constantly by stars and as part of their creation there are traveling waves in space that carry them along at the speed of light. I would propose that within a UD13 galaxy there is an overabundance of photon pairs and with the interference of traveling waves, photon pairs become separated from their original waves and bounce around (i.e., high velocity Brownian motion), at the speed of light, from one wave to another thereby having on average sub-light movement away from the galaxy. This would mean that they would accumulate within the space of the galaxy and hence increase in group density. Photon pair bubbles stretch space which acts as matter and with the high density of photon particles, the “dark foam” has the same effect as dark matter. It can’t be seen because it is simply the interference pattern of light and while the photons bounce around at light speed, their effective movement is sub-light and hence is not measured by sensors looking for them as particles or light energy. How do we calibrate dark foam? I would start with defining time \( t \) as an oscillation of some “thing” that will exist in a fairly constant gravitational field for the duration of the measurement. Define the center of the geometry as the black hole in the middle of the galaxy under analysis. Then define a spherical manifold, with \( dr \) thickness and radius \( r \) and concentric about the black hole. To estimate the dark matter, you would determine the flux through the manifold overtime versus the predicted light energy produced by the stars inside the manifold. It’s a bit tricky because the time period needed for the measurement but the dark matter would show up as basically the light that should have escaped the galaxy versus what the stars actually produces. If I am wrong, then there won’t be any light particles slowed down so Dark Foam will just be something that is associated with UD13 and have to be calibrated off the known amount of dark matter using gravitational estimates. The amount of Dark Foam should be related to the Star power of the galaxy. Given two galaxies of the same size, one “bright” and one not so bright, the brighter galaxy should have a higher ratio of dark matter to traditional matter than the dimmer galaxy.

So what is Dark Energy in terms of Dark Foam? Now consider the photon particles that leave the galaxy regions. Let’s say we have a cluster of galaxies that are clustered about an empty space. The photon pairs are carried into this region by gravitational waves which gradually decrease in amplitude. Eventually, the photon pairs are not trapped by the waves because their radiuses are too large and are slowed by interference waves. These photon particle pairs no longer ride the waves at the speed of light and slow down. Hence, their numbers or group density increases just as the density of the photon pairs inside the galaxy did but in this case, their speed is sub-light (i.e., low velocity Brownian motion). This means that their centripetal force of their bubble manifold decreases as well. The only thing keeping them as bubbles is their internal charge pressure and the containment forces related to the inversion point. Let’s assume they have a decay rate because the inversion point leaks charge from one positive bubble into the negative bubble where they will eventually collapse and hence expand the space around them. The space is expanded in part because of the space that made up the bubble manifold but it is even more expanded because when positive charged BFFF is combined with negative charged BFFF the result is more BFS. This inversion point leakage does not result into a sudden expansion of space but rather a continuous gradual increase of space.

An interesting observation would be to find some really old galaxies in a spherical cluster where the photon generation has decreased. If the real universe is like UD13 then the dark matter
should be less, as well as the dark energy. The cluster should be expanding less than the newer galaxies. Of course, relative sizes of the galaxies would need to be normalized out to make the estimate.

2.0 Matter from Energy: How bubbles form?
The BFS can have transversal and longitudinal waves. Electromagnetic waves are primarily formed by transversal waves as shown in an earlier subsection. Longitudinal waves come from rapid variation in Mass, such as a bubble bursting or a large number of bubbles collapsing into a much denser combination. What happens is that if the amplitudes of the transversal waves are really high and the amplitude of longitudinal waves is also extremely high, the BFS crashes into itself with enough force to cause an inverse point thereby entrapping BBFF and forming matter. This would happen in a Big Fantastic Bang (BFB).

2.1 Anatomy of a Black Hole: Formation of the Big Fantastic Black Hole
Even without a calibrated UD13 model, we can make some educated guesses on what would be in a Big Fantastic Black Hole (BFBH) and how it would evolve. It may also lead to a Big Fantastic Bounce (BFBo) and could be used to explain a repeating Big Fantastic Bang (BFB).

![Diagram of a Black Hole Core](image.png)

*Figure 1.7: Core of a black hole made from the BFS. Definitely not to scale.*
The gist of the idea can be visualized in a 1-D representation of the 3-D BFS model as shown in Fig. 1.7. Note that Fig. 1.7 is not to scale since it may contain as much matter/bubbles as the smallest black hole or in the case of a pre-BFB, it may contain all the matter in the universe. As the BFBH grows in mass, the core region would become extremely dense to the point that bubble matter would be packed together and elongated into the 4th spatial dimension in the resident BFFF. So for a Positive 1-D universe, the matter and photon particles would be compressed into the +BFFF space. The anti-photon particles would be the only bubbles in the −BFFF space. The result should warp the BFS to form a large convex shape extending into the +BFFF space with the concavity forming on the −BFFF side. Eventually, as the BFBH forms, the BFS would be warped into a circular (spherical in 2-D BFS) shape with a large volume of −BFFF space, with the inside of the concavity encircled by anti-photon particles. On the other convex side, the warped BFS would have compressed and elongated matter bubbles extending into the +BFFF. What would this look like in a 3-D BFS? It would look like a very small and very dense point of matter that is increasingly charged with −BFFF charge. The pressure on the +BFFF photon particles would skew their decay rate to be faster than their anti-photon particle counterparts. The +BFFF pressure on the other matter bubbles would also increase their decay rate or possibly decay threshold. This decay may not mean that the bubbles would completely deflate. Because of the gravitational pull and resulting extreme compression and bubble density, the bubbles would lose their BFFF contents but not necessarily their surface area. Hence, their mass would remain the same but their charge densities would decrease. In 3-D BFS the sub-atomic particles would appear to become smaller because they would be both deflated and compressed to extend deeper into the 4th dimension. Hence, their projection onto the 3-D BFS would become smaller. At some point, it might be possible for an anti-photon to collapse a +BFFF matter bubble far larger than a single photon particle. This may lead to a collapse of the BFBH and lead to the BFB and recreation of the BFS Universe as we know it.

2.2 UD13 Big Bang Theory?

I can’t help but notice that when people, throughout history, extrapolate the boundaries of their conceptual universe they end up being really wrong until they finally measure or explore the boundaries. When people in the western world thought the universe was a flat earth they extrapolated waterfalls around the edge with various giant animals or titans holding the earth up. We now consider galaxies common place while the first galaxy was discovered by Hubble in 1925, less than 100 years ago. Then there were black holes, inflation and planets in other solar systems, etc. Our conceptual boundaries are expanding and so is our extrapolation of what is beyond these boundaries. When I was very young I read a book by Albert Einstein where he discussed a multi-dimensional universe based on hyper-spheroids. In that model, a laser beam would eventually come back to the same place but from the opposite direction. As far as I know, no one has proved or disproved that theory.

More recently I primarily hear about dark matter, dark energy, multi-verses, etc. Spatially it would seem the universe goes on in 3-D forever. What about time? Was there nothing before the big bang and what will the real universe evolve into? Will it evolve into one big fantastic black hole and become cyclic with a big crunch followed by a black hole followed by a big bounce, etc.? With inflation and the law of thermodynamics, … maybe not? Will the stars die, the black holes decay and electromagnetic energy spread out and converge to 0 amplitude into a Big
Freeze? Will the universe collapse back to nothing at that point? Or will a parallel universe crash into our universe? Whatever it is, what are the odds that we have no clue how the universe will evolve?

2.2.1 Option 1 for UD13: Four Simple Scenerios

As for UD13, we do have options as to how it would evolve. Just from a programming standpoint, a cyclic model would be nice so that UD13 would eventually reset or restart itself. So here is what I am thinking for a repeating lifecycle of UD13:

1. In subsection 1.9, I mentioned that there is a decay rate for bubbles because of leakage through the inversion point. Furthermore, when positive BFFF comes into contact with negative BFFF, it creates more BFS. Bubbles decay into gravity waves and more BFS.
2. Let’s assume that the UD13 goes into a big freeze where the bubbles all decay and the gravity waves in the BFS stochastically distribute toward white noise. Gravity waves distribute to white noise.
3. Let’s assume that the BFS also decays directly to +BFFF or –BFFF depending on which it is in contact with. BFS decays to +BFFF and –BFFF.
4. Let the universe evolve into a single BF Black Hole (BFBH) plus a little excess matter and photon particles and BFS wave noise distributed sparsely throughout the universe. Then the BF black hole goes unstable and explodes into what we would call a Big Bang or for UD13, a BF Bang and the universe as we know it, starts over.

Item 1 is basically an expansion that goes on until all bubbles, matter or photon particles, decay. Item 2 is the UD13 version of a Big Freeze. How low the average energy density goes depends on how you look at it. That is, if you assume the BFS is infinite and that there is also an infinite amount of bubbles formed during the Big Bang then without item 3, the white noise variance would asymptotically approach a constant. Item 3 will lead to holes in the BFS where it has decayed away and will let the +BFFF come into contact with –BFFF which will distribute Big Bangs throughout the universe. So if this occurred in our real universe why would we not be seeing galaxies cross cutting through our real universe from other Big Bangs? Maybe because the individual Big Bang BFS expansions prevent them from interacting. The simplest option at this time is to assume there is a finite amount of energy, just enough to grow a BFBH described in item 4 which becomes the BFB that starts the process over. The real hope is that if the decay rates are all set right, the UD13 will result in a cyclic Universe.

2.2.2 Option 2 for UD13: Dimensionally Nested Multi-verse with Hyper-Spherical BFS

An interesting form of UD13 allows creation of Universes thru tearing apart the 3-D BFS manifold. This is more of a science fiction concept rather than a framework for existing science. Never the less, it brings up some interesting questions. Instead of focusing on parallel Universes with similar properties, consider a “FlatLand” Model by Edwin A. Abbott, where each N-D Universe manifold may contain multiple (N-1)-D Universes as shown in Fig. 1.8 (left).
Furthermore, consider a possible structure of an N-D BFS manifold that would allow the creation of (N-1)-D BFS universes within its N-D space. Assume that all N-D BFS’s are “polarized” so that if you could tear them apart and reverse the N-D directions of the torn BFS section then when it would come in contact with the original BFS structure, it would form an (N-1) boundary manifold which has a global geometry of an N-D spherical manifold as shown in Fig. 1.8 (right). During the process of creation, there would be bubbles formed that exist both inside and outside of the N-D spherical manifold containing the (N-1)-D BFS universe. Also assume that the inverted N-D BFS has an attraction to the non-inverted N-D BFS. Does this sound familiar? It should because in the basic UD13 model, the 3-D BFS is sandwiched between two 4-D BFFFs which are attractive to one another. If the nested model were true, then it implies that our 3-D BFS manifold is a hyper-spheroid and that there would be an inside and an outside of this 4-D spherical manifold. Parallel 3-D universes would then be other hyper-spheres floating around in the 4-D space.

### 2.2.3 Creating (N-1)-D Universes

How could we create an (N-1)-D universe? There are two ways that would have extreme forces needed to tear and invert the BFS. The first method is within a Black Hole where the bubbles are compressed so much that they tear and invert at the inversion point, as shown in Fig. 1.9. The other way occurs when two black holes pass close enough and fast enough to tear and invert the BFS between the event horizon boundaries and then fling the resulting 2-D manifolds into 3-D space as spherical manifolds, as shown in Fig. 1.10. Event horizons may even be able to intersect and then tear apart. Conceptualizing this process requires some loosening of relativistic rules. For example, as matter or an object (bubbles in the case of UD13) descends toward an even horizon, reflected light off the matter (viewed from a great distance) begins to slow down as it...
leaves the object and moves away from the event horizon. As the object intersects the event horizon, photons may reflect out from the object's surface on the outside of the event horizon but there will be much less reflection (exception for highly energetic photons like gamma rays) from the surface within the event horizon. What Dr. Leonard Susskind argues is that photons reflecting orthogonal to the black hole core will effectively orbit the black hole thereby forming a Fourier Transform within the event horizon boundary. What happens inside the event horizon? If the reflected photons reach 0 velocity, does “time” stop? For the UD13 model, let’s assume “time” never stops and that it effectively slows down because causality slows down across highly stretched regions of the BFS but even in a black hole, things that enter the event horizon will wind up either orbiting or more likely, become part of the black hole core. What does this assumption do for us? I think it allows us to intersect the event horizons as two black holes pass closely to one another and with enough velocity, the two black holes pass by one another without merging and more importantly, re-separate their event horizons.

Formation of 2-D Universe within a Black Hole Core via Compressed Bubble

Universes formed by the method shown in Fig. 1.9 would be locked inside the black hole until it decays. Once the black holes decay, the (N-1)-D universes would be released into N-D space as N-D spheroidal manifolds. These would not be bubbles which exist in (N+1)-D space. In fact, their attraction forces would not act on the matter (bubbles) of the N-D BFS they are within. The (N-1)-D universe spheres would have gravitation pull and would probably increase in size when expelled from the black hole. Seen from within these (N-1)-D universes, this expansion period might be seen as what we would call “expansion”. What would happen if a 3-D BFS bubble collided with a 2-D universe sphere? Not a lot. They would interact gravitationally but as the bubble “rolled” through the 3-D spherical manifold, the manifold would simply follow the surface of the bubble into 4-D space and then back again as the bubble passed by. This gravity only interaction sounds a whole lot like “dark matter.”

If the creation of the (N-1)-D universes are possible by the method shown in Fig. 1.10 then it means that it might be possible for N-D civilizations to orchestrate the creation of (N-1)-D universes, albeit over long periods of time to redirect things as large as black holes. Whether by
the orchestrated motion of black hole collisions or by naturally occurring collisions, these (N-1)-D universes may be larger than the ones formed inside the black hole and may be present sooner in our N-D universe since they do not require the black hole to decay in order to be released.

Formation of 2-D Universes between two Black Hole Event Horizons via Spatial Tearing

![Figure 1.10: Process of (N-1)-D universe creation from near collision of two black holes.](image)

Why would this be important? Let’s go a little farther into our science fiction. Assume that nested universes have two properties that not necessary independent. First, assume that for an N-D universe, the minimum bubble size is affected by the value of N. So, for the case of our 3-D universe, a 2-D universe would have either larger bubbles, same size bubbles or smaller bubbles. Second, assume the rate of causality is dependent on N. So, for the case of our 3-D universe, a 2-D universe would have either a slower rate of causality, the same rate or a faster rate of causality. Given these two assumptions we would have 9 different combinations. Let’s just focus on one combination where we assume the 2-D universe is much finer grain than our 3-D universe such that the bubble sizes are significantly smaller. And the 2-D universe has a significantly faster rate of causality. In this case, if we were able to monitor the 2-D universe we would find its speed of light much faster than ours and its evolution much faster. In fact it might exceed our universe in the evolution of intelligent life. If we could pose our 3-D problems to these “Midichlorians” then they may be able to solve them for us. Maybe there are 4-D civilizations waiting for us to reach a point to process data for them? This scenario would also explain why our electro-magnetic fields are so consistent over time since the 4-D universe would be changing much slower than our 3-D one.

APPENDIX A: 4-D AFFINE TRANSFORMATION MATRICES
The 3-D affine transformations are well known and are implemented using 4x4 matrices. The individual affine transformations include scaling, translation and rotation. The 4x4 scaling product is

\[
\begin{bmatrix}
    x_2 \\
    y_2 \\
    z_2 \\
    w
\end{bmatrix} =
\begin{bmatrix}
    s_x & 0 & 0 & 0 \\
    0 & s_y & 0 & 0 \\
    0 & 0 & s_z & 0 \\
    0 & 0 & 0 & 1
\end{bmatrix}
\begin{bmatrix}
    x_1 \\
    y_1 \\
    z_1 \\
    1
\end{bmatrix}
\]

(A.1)

The 4th row of the transformation matrix in Eq. (A.1) is often used for perspective distortion and graphics specific applications which will not be used in UD discussion. So the 4th element of the output vector will always be unity. The diagonal elements are used for scaling. The 4x4 translation product is given by

\[
\begin{bmatrix}
    x_2 \\
    y_2 \\
    z_2 \\
    w
\end{bmatrix} =
\begin{bmatrix}
    1 & 0 & 0 & t_x \\
    0 & 1 & 0 & t_y \\
    0 & 0 & 1 & t_z \\
    0 & 0 & 0 & 1
\end{bmatrix}
\begin{bmatrix}
    x_1 \\
    y_1 \\
    z_1 \\
    1
\end{bmatrix}
\]

(A.2)

The translation offsets are in the 4th column of the transformation matrix in Eq. (A.2). It is translation operation that makes it desirable to use 4x4 matrices to process 3-D coordinates. There are 3 rotation matrices indicated by Rot(x, \( \theta \)), Rot(y, \( \theta \)) and Rot(z, \( \theta \)). These are referred to as rotation about X, rotation about Y and rotation about Z, respectively. However, this terminology only applies to 3-D space. A more general reference would rotation within YZ plane, rotation within XZ plane and rotation within the XY plane, respectively. The three transformations in order are

\[
rot(x, \theta) = R_{YX} = \begin{bmatrix}
    x_2 \\
    y_2 \\
    z_2 \\
    w
\end{bmatrix} =
\begin{bmatrix}
    1 & 0 & 0 & 0 \\
    0 & \cos \theta & -\sin \theta & 0 \\
    0 & \sin \theta & \cos \theta & 0 \\
    0 & 0 & 0 & 1
\end{bmatrix}
\begin{bmatrix}
    x_1 \\
    y_1 \\
    z_1 \\
    1
\end{bmatrix}
\]

(A.3a)

\[
rot(y, \theta) = R_{ZX} = \begin{bmatrix}
    x_2 \\
    y_2 \\
    z_2 \\
    w
\end{bmatrix} =
\begin{bmatrix}
    \cos \theta & 0 & \sin \theta & 0 \\
    0 & 1 & 0 & 0 \\
    -\sin \theta & 0 & \cos \theta & 0 \\
    0 & 0 & 0 & 1
\end{bmatrix}
\begin{bmatrix}
    x_1 \\
    y_1 \\
    z_1 \\
    1
\end{bmatrix}
\]

(A.3b)

\[
rot(z, \theta) = R_{XY} = \begin{bmatrix}
    x_2 \\
    y_2 \\
    z_2 \\
    w
\end{bmatrix} =
\begin{bmatrix}
    \cos \theta & -\sin \theta & 0 & 0 \\
    \sin \theta & \cos \theta & 0 & 0 \\
    0 & 0 & 1 & 0 \\
    0 & 0 & 0 & 1
\end{bmatrix}
\begin{bmatrix}
    x_1 \\
    y_1 \\
    z_1 \\
    1
\end{bmatrix}
\]

(A.3c)
For a 4-D space we will use 5x5 matrices to perform the affine transformations. The 4th dimension will be represented by \( w \). For the 4-D space, there are 6 different rotation matrices which will be referred to as \( R_{XY} \), \( R_{XZ} \), \( R_{XW} \), \( R_{YZ} \), \( R_{YW} \) and \( R_{ZW} \). These matrices are

\[
R_{XY} = \begin{bmatrix}
    x_2 \\
    y_2 \\
    z_2 \\
    w_2 \\
    v
\end{bmatrix}
= \begin{bmatrix}
    \cos \theta & -\sin \theta & 0 & 0 & 0 \\
    \sin \theta & \cos \theta & 0 & 0 & 0 \\
    0 & 0 & 1 & 0 & 0 \\
    0 & 0 & 0 & 1 & 0 \\
    0 & 0 & 0 & 0 & 1
\end{bmatrix}
\begin{bmatrix}
    x_1 \\
    y_1 \\
    z_1 \\
    w_1 \\
    1
\end{bmatrix}
\] (A.4a)

\[
R_{XZ} = \begin{bmatrix}
    x_2 \\
    y_2 \\
    z_2 \\
    w_2 \\
    v
\end{bmatrix}
= \begin{bmatrix}
    \cos \theta & 0 & -\sin \theta & 0 & 0 \\
    0 & 1 & 0 & 0 & 0 \\
    \sin \theta & 0 & \cos \theta & 0 & 0 \\
    0 & 0 & 0 & 1 & 0 \\
    0 & 0 & 0 & 0 & 1
\end{bmatrix}
\begin{bmatrix}
    x_1 \\
    y_1 \\
    z_1 \\
    w_1 \\
    1
\end{bmatrix}
\] (A.4b)

\[
R_{XW} = \begin{bmatrix}
    x_2 \\
    y_2 \\
    z_2 \\
    w_2 \\
    v
\end{bmatrix}
= \begin{bmatrix}
    \cos \theta & 0 & 0 & -\sin \theta & 0 \\
    0 & 1 & 0 & 0 & 0 \\
    0 & 0 & 1 & 0 & 0 \\
    \sin \theta & 0 & 0 & \cos \theta & 0 \\
    0 & 0 & 0 & 0 & 1
\end{bmatrix}
\begin{bmatrix}
    x_1 \\
    y_1 \\
    z_1 \\
    w_1 \\
    1
\end{bmatrix}
\] (A.4c)

\[
R_{YZ} = \begin{bmatrix}
    x_2 \\
    y_2 \\
    z_2 \\
    w_2 \\
    v
\end{bmatrix}
= \begin{bmatrix}
    1 & 0 & 0 & 0 & 0 \\
    0 & \cos \theta & -\sin \theta & 0 & 0 \\
    0 & \sin \theta & \cos \theta & 0 & 0 \\
    0 & 0 & 0 & 1 & 0 \\
    0 & 0 & 0 & 0 & 1
\end{bmatrix}
\begin{bmatrix}
    x_1 \\
    y_1 \\
    z_1 \\
    w_1 \\
    1
\end{bmatrix}
\] (A.4d)

\[
R_{YW} = \begin{bmatrix}
    x_2 \\
    y_2 \\
    z_2 \\
    w_2 \\
    v
\end{bmatrix}
= \begin{bmatrix}
    1 & 0 & 0 & 0 & 0 \\
    0 & \cos \theta & 0 & -\sin \theta & 0 \\
    0 & 0 & 1 & 0 & 0 \\
    0 & 0 & \sin \theta & 0 & \cos \theta \\
    0 & 0 & 0 & 0 & 1
\end{bmatrix}
\begin{bmatrix}
    x_1 \\
    y_1 \\
    z_1 \\
    w_1 \\
    1
\end{bmatrix}
\] (A.4e)
\[
R_{ZWP} = \begin{bmatrix} x_2 \\ y_2 \\ z_2 \\ w_2 \\ v \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & \cos \theta & -\sin \theta & 0 \\ 0 & 0 & \sin \theta & \cos \theta & 0 \\ 0 & 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ y_1 \\ z_1 \\ w_1 \\ 1 \end{bmatrix}
\] (A.4f)

The scale and translation matrices for 4-D are respectively

\[
\begin{bmatrix} x_2 \\ y_2 \\ z_2 \\ w_2 \\ v \end{bmatrix} = \begin{bmatrix} s_x & 0 & 0 & 0 & 0 \\ 0 & s_y & 0 & 0 & 0 \\ 0 & 0 & s_z & 0 & 0 \\ 0 & 0 & 0 & s_w & 0 \\ 0 & 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ y_1 \\ z_1 \\ w_1 \\ 1 \end{bmatrix}
\] (A.5)

and

\[
\begin{bmatrix} x_2 \\ y_2 \\ z_2 \\ w_2 \\ v \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & t_x & 0 \\ 0 & 1 & 0 & t_y & 0 \\ 0 & 0 & 1 & t_z & 0 \\ 0 & 0 & 0 & 1 & t_w \\ 0 & 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ y_1 \\ z_1 \\ w_1 \\ 1 \end{bmatrix}
\] (A.6)