A Logical View Of Gravity

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Why I Wrote This

It's important to stress that as you read this, you shouldn't expect to be reading a scientific thesis, packed with page after page of formulas, equations and higher mathematics. However, while not a mathematically based article, there is a level of math being used. That cannot be avoided.

So what is this article? I describe the step-by-step progression I used as I considered gravity, from what I learned way back in fifth grade, up to Dark Energy and Black Holes.

Each step in that progression of my thinking was arrived at in a logical process. Then, with that step established, I took the thinking to the next step. Each step was based on a logical analysis and determination of previous steps.

I begin with a lesson I had back in grade school. I'm sure we all heard the same thing in science classes -- *"All objects fall at the same speed."* That idea, that all objects, from feathers to a full sized car, fall at the same speed just felt wrong. It felt so wrong that it has bothered me since then.

So why this article?

For want of a better phrase, this article is the result of an itch I've had for a very long time. And, I finally just had to scratch it. At some point as I had refined my thinking about gravity – *what is it and how it does what it does,* I had to take if from thoughts in my head and get it onto to paper. One reason I had to write it down was to force me to bring all my thoughts to a sharp focus. Another reason to put it on paper, was to preserve it for all time.

My deep thanks goes to Sandra Welborn, who as the publisher of Waltsan Publishing gave me the opportunity publish my ideas.

For as long as I can remember, I've been fascinated by all of the physical sciences. I attended college at Wright State University in Dayton, Ohio and obtained an MS in geology. After graduation, I entered the oil industry. As an exploration geologist, I found the hunt, the search for the deep, unseen reservoirs of oil to be the most interesting aspect of the field.

The task of an exploration geologist is to take stray bits of information, bring them together and form a picture of the geologic structures that exist as deep as 10,000 feet below the surface. I viewed the exploration process as being very much like a treasure hunt: sorting through a maze of information, taking the bits which were needed, discarding the bits that were not. Then, came the hunt. With all of the pertinent information at hand, the geologist makes a logical argument concerning the size, location and depth of the prospect. Oh, the last step is to present the proposal to management and to convince them to spend upwards of 15 million dollars to drill and test your idea.

I found that intriguing and sobering.

I applied that same love of the quest to my fascination with gravity.

I began this article with a discussion of what I had heard when I was in grade school – *"All objects fall at the same speed."* That felt like an inconsistency and it bothered me.

Many years passed, as tends to happen when life gets in the way of even the strongest of interests. In 2005, the interest got an influx of energy.

What I present here is a discussion of a building process that began in 2005.

I discuss the question of why falling objects only *seem* to fall at the same speed. Then I move on to an observation of a solar total eclipse in 1919. I looked at the eclipse in a way I had not seen before. From that observation, I conclude a logical explanation of how and why gravity works. This may come off as arrogant, but I point out how the explanations I have seen for years do not work for me. I establish a logical conclusion about what gravity is. This presentation of what gravity is and why it does what it does, is one I had never seen before.

Then, using that "Logical Conclusion," I look deeper into the what, how and why of gravity. By using that logical conclusion as a foundation, I expand it slightly to discuss another idea. Once I have explained that idea, which was based on a logical conclusion, I moved on to another idea. Step-by-step, I built on the idea of what gravity is and take it to the concept of Dark Energy and how it fits into gravity. Then, I discuss Black Holes and the reason they are "Dark" with no light escaping from them.

This paper is the result of quite a few years of thinking, analyzing and developing. If the late Stephen Hawking were to have read these ideas, he quite possibly would have thought it to be off the mark. But these are my ideas. I firmly believe the reality of gravity to be what is written here, or the reality is very close to this. Even though my thoughts and comments might be seen as speculative, all aspects are presented in a logical, positive manner.

A Logical View Of Gravity

Sections

Introduction

What is gravity?

That sounds like a simple question. *What is gravity?*

But, as stated above, that question has bothered me for many years, because it seems like it should be easy to answer. However, that question is one of the most difficult questions out there.

What is gravity?

Everyone knows the cliché answer. Gravity is what holds us to the ground. If we stumble and fall, gravity pulls us down and we skin our knees. In one of Robin Williams' comedy routines, he had a joke that encapsulated both the simple nature of gravity and its unknown aspect. As he put it, "I stubbed my toe and landed square on my forehead. After I saw no one was laughing at me, I stood up and muttered, 'Oh s**t, gravity works.'"

He was right. Gravity works. But the thing is, no one really knows why or how it works. That's what has always fascinated me – the why and how of gravity.

Sir Isaac Newton discovered gravity in 1666. The legend is that he was sitting under an apple tree on a warm Summer day when an apple fell from a tree. Again, the legend is that as he sat there, he wondered why the apple fell down. Why didn't it fall up or to the side? It fell down.

From that observation, Newton developed the idea of gravity. He expanded that initial observation to the theory about gravity and how gravity pulls everything toward the Earth. He went on to formulate how gravity is the force that controls the movement of the Moon around the Earth.

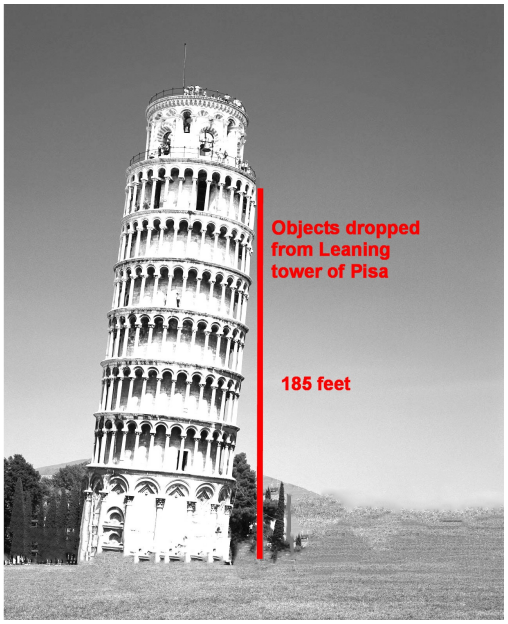
My questions about gravity began in the 5th grade. Every day we would have a classroom segment about science. We learned about the parts of flowers, how a prism can break light into its basic components and during one class, we touched on gravity.

In that one shot at the subject, the teacher told us about an experiment that Galileo had done and how his work affected the understanding of gravity.

Almost a century before Newton had discovered gravity, Galileo had made an important observation. His observation was linked to gravity, but the idea of a force pulling objects

toward the Earth didn't come about until Newton had his encounter with the apple.

In 1589, at the Leaning Tower of Pisa, Galileo dropped two objects of different weights from the top of the tower.



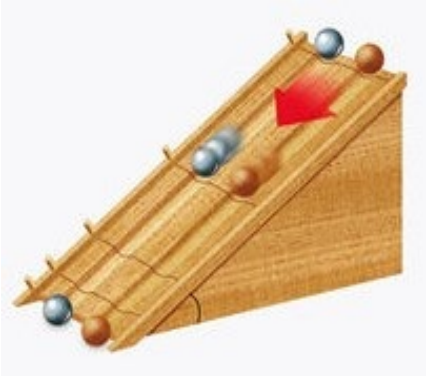
Galileo dropped objects from the Leaning tower of Pisa

Both of the objects fell at the same speed and they both hit the ground at the same moment. This experiment by Galileo was before Newton had put a name, gravity, to the force that pulls everything toward the Earth.

All objects fall at the same speed.

Even in the 5th grade, that made absolutely no sense to me. The teacher did add that the air resistance acting on the falling objects would affect the speed at which they fell. That meant if I dropped a feather and a baseball at the same time, the resistance of the air on the feather would have more impact that it would on the ball. So in that case, the ball would hit the ground first. But that difference was due to the effect of the air, not due to anything related to gravity. So, that didn't really help.

Galileo repeated the experiment by rolling two balls, of different weights, down an inclined plane. Rolling down the inclined plane reduced the effect of gravity and slowed the experiment. The slower speed allowed him to be more precise in determining their rate of fall. Even at a reduced speed, the two balls hit the ground at the same time.


Inclined Plane

Despite what was written in my text book, or what my teacher and even Galileo had told me, I still couldn't accept as the truth that all objects fell toward the surface of the Earth at the same speed.

In my elementary school way of thinking, I did a thought experiment. If I had two similar wagons and I pushed the first wagon with more force that I pushed the second, the first wagon will move faster. If this "more force results in more speed" analogy worked with wagons, why not falling objects? With two objects, when object #1 weighed more than object #2, why would object #1 not fall faster than object #2? Observation reveals that they do in fact fall at the same

speed. So, why?

What also bothered me in the 5th grade was the fact that if two objects fell at the same speed, why would the two objects not weigh the same? The fact that they did not weigh the same, made no sense. Falling at the same speed, they should weigh the same. But, as I held a baseball and a paperclip, they were of different weights, but yet they fell at the same speed.

Those questions bothered me for years.

A few years later, in my high school physics class, we didn't spend very much time on gravity, except to repeat Galileo's demonstration. We dropped a ball point pen and a baseball. They hit the floor at the same time.

Then in order to be more precise, in the way Galileo had done the experiment, we slowed the demonstration by using two small metal balls, of different weights, rolling down an inclined plane. The effect of gravity on falling objects was the same, only slower and easier to study.

You guessed it, even on the inclined plane, they both reached the bottom at the same time. Again, Galileo was shown to be right. Objects always fall at the same speed.

That same scenario played out in my college physics class. Same demonstration, two objects dropped at the same time. Same results, they hit the ground at the same time. I came away from that demonstration with the same pronouncement, ALL objects, when not affected by air resistance, fall at the same speed. Only this time, I learned that falling objects don't just fall at a set speed. All objects on the surface of the Earth, when dropped, accelerate at the same constant rate.

On the surface of the Earth, falling objects accelerate toward the center of the Earth at a rate of 32 feet/second/second. That means that with every second, the velocity of the falling object increases by 32 feet per second. After one second, the object is moving at 32 feet/second. After two seconds, it is falling at 64 feet/second. Three seconds, 96 feet/second. And so on.

So the longer an object falls, the faster and farther it falls. But the idea was the same, ALL objects, when they are in free fall, behave the same way. Only now, I used the phrase, they accelerate at the same rate.

Then in 1971, during the Apollo 14 mission to the moon, Alan Shepherd had a spectacular

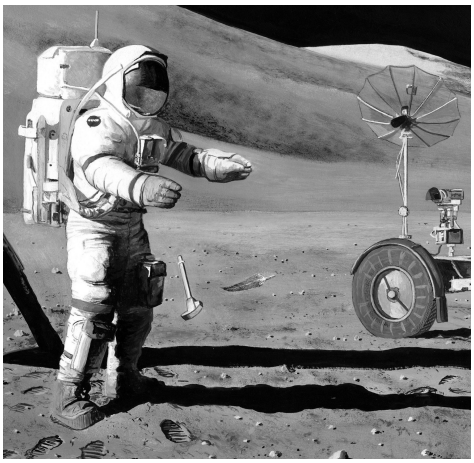
demonstration in which he showed that two falling objects, with no air resistance, do in fact fall at the same rate. This would, the thinking went, prove the universality of gravity. It was on one of Shepherd's moon walks that, televised live around the world, he dropped a hammer and a feather. In the absolute vacuum of space, there would be no air resistance, so this was going to be the proof.

The image on the right is a NASA reconstruction of that demonstration. The original photograph was taken from the 1971 video from the moon. It was quite blurry and difficult to see, so NASA redid the image to be less fuzzy.

Shepherd dropped the hammer and the feather at the same moment. And, right there, from the moon, for all to see on live television, the hammer and the feather, free from any air resistance, fell at the same speed. They hit the surface of the moon at the same moment. It was a once in a lifetime demonstration.

After both the hammer and the feather hit the surface at the same time, Shepherd commented, "I guess Mister Galileo was correct."

There it was, the final proof. First, it was in elementary school, then in high school, and then in college, all objects fall at the same speed. Even NASA and Alan Shepherd had taken extremely valuable time from a moon mission to add to the proof.



NASA reconstruction of Shepherd testing gravity.

And yes, after Shepherd's 1971 time on the moon, I thought about how the NASA demonstration was from the Moon and every bit of evidence about objects falling at the same speed was on Earth. I wondered how, and to what extent, would the different locations impact the results?

But, even with so many demonstrations pointing to that idea that all objects fall at the same rate, I still didn't buy it. There was something wrong with that entire idea. I couldn't escape that one very simple question that had bothered me since the 5th grade – if all objects fall at the same rate, why do all objects not weigh the same? If I couldn't sort out that seemingly basic question, I couldn't put my finger on what gravity actually is.

My skepticism grew. However, by that point, I had enough information that I was determined to

figure out the falling object question. First that, then the rest.

I had learned the equation for the force of gravity, so I put it to good use to figure out why and if objects always fall at the same rate.

The Question Of Falling Objects

As I go through the details of how I resolved a good deal of my confusion about gravity, along with the question of why all objects fall at the same time, I found I needed to use a bit of mathematics. The math involved in the discussion isn't calculus or complicated algebra. The explanation does involve large numbers and exponents.

I know there are some who do not want to get into that much detail. So, for those who want to by-pass the math, let me bottom-line the discussion in this section. Here is a quick answer to why all objects *seem* to fall at the same speed. The next section will delve a bit more into the mathematics.

The equation for the force of gravity is: $F=G\frac{M_1 M_2}{R^2}$

Two parts of the equation that can be ignored in this examination are:

- *G*. G is a constant and for the purposes of this discussion, can be ignored.
- *R^2*. R^2 is the square of the distance between the two objects. When dropping objects, the distance "R" is the distance between the objects and the center of the Earth. When comparing the speed which a baseball falls to the speed which a feather falls, R is the same distance between each object and the center of the Earth. Therefore, for the purpose of this discussion, R^2 can be ignored.

Taking out those two factors, F, the force of gravitational attraction between any two objects comes down to the factor – M_1M_2.

M_1 is the mass of the Earth, which is huge.

M_2 is the mass of any other object. When the mass of any object, from an Army M1A1 Abrams tank to a paperclip, M_2 shrinks to insignificance.

Let's look at what that means. M_1 is the mass of object #1, the Earth. M_2 is the mass of object

#2, the object being dropped.

Let's compare what happens it we drop objects a hammer, a baseball, a paperclip or even an enormous Army M1A1 Abrams Battle Tank. With any of those four objects as M_2, a hammer, a baseball, a paperclip or even an Army tank, their masses are insignificant in the extreme when they are compared to $M_{1,}$ when M_1 is the mass of the Earth. No matter how large M_2 is, the factor, M_1M_2, essentially becomes M_1 ,the mass of the Earth. Therefore, the mass of the Earth controls the force of gravitational attraction. So everything, from an Army tank to a paperclip, only *seems* to fall at the same speed, especially when observed with the naked eye.

And the key to the generalization that all objects fall at the same speed, is that when observed with the naked eye and not mesured electronically, all objects only ***SEEM*** to fall at the same speed.

What is Gravity?

As described above, I had determined the reason why all objects do not, in fact, fall at the same speed. They only *seem* to fall at the same speed. As I considered that, I wondered why so many people, people who I suspect actually knew the truth, still spoke in generalities. What bothered me most was that I had been told these generalities in my college physics class, a class where I should have learned the truth, not a cliché.

However, finally figuring out the truth actually whetted my appetite to learn more about that mysterious force, gravity.

Several years passed and I read different ideas concerning gravity. It wouldn't be worth going over the different ideas I read, other to say that they didn't make sense. I know that in a world where the Theory of Relativity and the idea of Quantum Mechanics exists, to hold to the notion that an idea has to be logical, can be naive. Quantum Mechanics, almost by definition, defies common sense logic.

Before I could accept the idea of what gravity is, at some level it had to make sense. And, so far what I had learned simply did not make sense.

My next consideration led to what was an *Ah Ha* moment.

Up until that time, I had accepted the idea that gravity was one of the four fundamental forces in nature. These four forces were, for the most part, considered to be pretty much ubiquitous forces. They just existed.

The four fundamental forces named are:

- The *strong interaction force* – the force that is responsible for holding the nuclei of atoms together.
- The *electromagnetic force* – the force that causes electric and magnetic effects, such as the repulsion between like electrical charges or the interaction of bar magnets.
- The *weak force* – the nuclear force which is responsible for radioactive decay.
- The *gravitational force* – the weak force which is always attractive, never repulsive.

There were many articles about why gravity was automatically considered to be one of the four fundamental forces. But I didn't buy into them. The reasons they gave just didn't make sense.

I began to see gravity as a separate force, not one of the Fundamental Forces after I thought about a total solar eclipse that took place on May 29th, 1919.

The British astronomer, astrophysicist, and mathematician, Sir Arthur Eddington set out to prove one of the aspects of Einstein's Theory of Relativity, that gravity will affect light. To do that, he went to Principe Island, off the west coast of Africa to view a solar eclipse. The purpose of viewing the eclipse was to determine if the gravity from a massive body, like the sun, would distort space and bend light.

Principe Island, site to solar eclipse in 1919

The date and position for the observation of the eclipse were chosen because the path of the total eclipse would cross directly over the island. At the time of the eclipse, a star was positioned behind the sun, and therefore should not been seen on Earth. However, the thinking went, during a total eclipse, when the blinding face of the sun was blocked out, if

Einstein was correct and the gravity of the sun did bend the light from the hidden star, it might be possible to see the star.

The result was that Eddington could see the hidden star. The light from the star had been bent around the sun. From that observation, the conclusion was that gravity did warp the fabric of space and did bend light. Further, Einstein's Theory of relativity was now accepted as true.

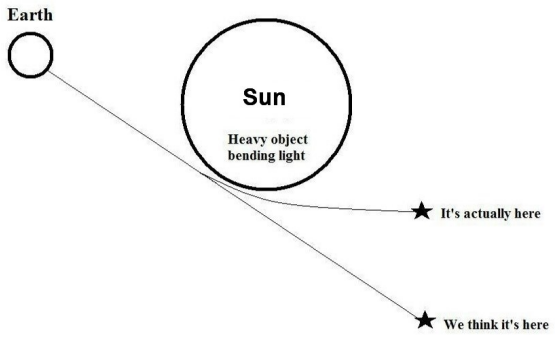
For a long time, I accepted the results of the eclipse as the Gospel. After all, Einstein had predicted it. Every physicist accepted it. It was even in my college physics book. The consensus was that – as seen during the eclipse, gravity from the Sun bent the light around it.

The accepted conclusion – *Gravity bent light. Gravity affected the path of the individual photons*.

I didn't agree. However, I mused, "What kind of a counter argument to Einstein could come from a geologist?" I was putting my reasoning up against everything I had learned about gravity. But, I continued.

Concerning the Eddington eclipse of 1919, was the light from the hidden star, bent due to the gravity of the sun? What had caused that beam of light from the hidden star to bend around the sun? Did something about the sun cause the light to bend? If so, what was that something?

There are three possibilities to consider about how the Sun could bend a beam of light.



The three possibilities are:

1. Possibility #1) The sun's gravity did bend the beam of light.
2. Possibility #2) The mass of the sun produced a static warp, or an inward pucker, to the space surrounding it.
3. Possibility #3) The mass of the sun produced an Active Warp. The mass of the sun pulled the fabric of space into it. As space moved toward the sun, everything near it was pulled

with it.

Let's look at possibility #1 concerning how the Sun could bend a beam of light..

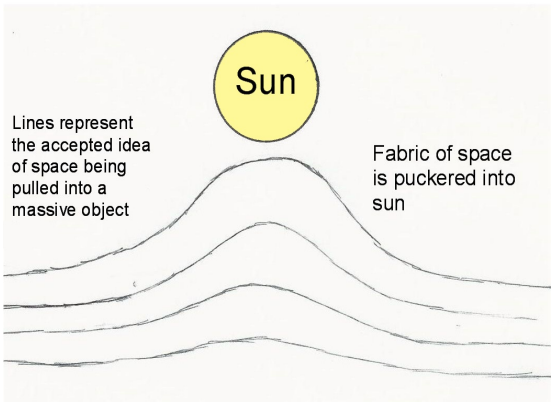
$$F = G\frac{M_1 M_2}{R^2}$$

From the equation for the force of gravity, we already determined that the key factor in determining the attraction between two objects is the factor M_1M_2. When applying the values for that factor to the mass of the sun and the mass of the photons of light passing it, we get the mass of the sun, M_1, which is huge. However, the mass of a photon of light, M_2, is 0 (zero).

No matter how large the mass of M_1 is, when the mass of light, M_2, is 0, the value of the factor, M_1M_2, is 0. When the factor M_1M_2 is 0, the value for the force of attraction between the sun and light F is 0.

With the value of F equal to 0, there is no gravitational attraction between the sun and the photons of light. It's simple math. There is no gravitational attraction between the Sun and the photons of light. Yet, the beam of light from the hidden star *did* bend around the sun. Why?

Let's look at possibility #2 concerning how the Sun could bend a beam of light. The mass of the sun produced a static warp, or an inward pucker, to the space surrounding it. Einstein, and others, have theorized that objects with mass will warp the fabric of space inward to the sun. This warp is seen as space pulled inward. As the light from the hidden star passed through the warp of space, it would have to have been deflected by that warp in order for it to bend around the sun.



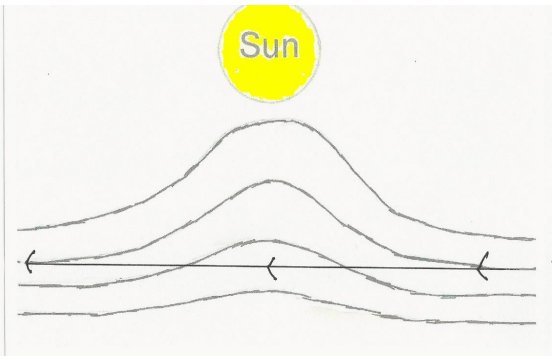
To the right is an illustration of a proposed warp in space, inward toward the sun. The illustration represents 3D space on a 2D paper. It represents the fabric of space being pulled inward by the mass of the sun. The nearer

the sun, the more warp is applied to space and the more it is pulled into the sun. The warp into the sun, as it is theorized by scientists, is seen as a static warp.

A static warp is defined as where the fabric of space is puckered inward toward the sun. The effect of gravity on an object, the theory goes, is the interaction of an object in the warped area of space. The idea of a static warp bending light doesn't work for me. Since the individual photons of light do not have any mass, they are unaffected by the force of gravity as explained by the equation:

Since the force of a gravitational attraction will not bend light, will the presence of a static warp bend light? No! Light travels in a straight line, unless it interacts with a medium, such as glass or water.

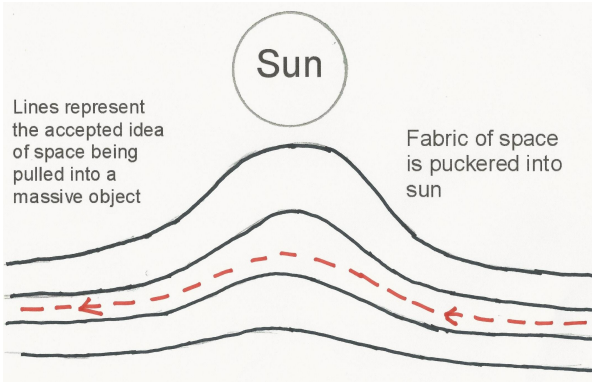
Let's look at two examples of how light *might* be impacted by the Sun's static warp of space.



Example #1

Example #1. In this diagram, light is doing what light does, it moves in a straight line. In this case, the passing light is not impacted by the inward warping of space, toward the sun. As the beam of light travels in a straight line it would pass the sun without being bent around the sun. In this example, the light from the hidden star could not have been seen by Eddington during the 1912 eclipse.

Example #2. In the next diagram, the beam of light from the hidden star enters the area of the static warp into the sun. As the fabric of space is pulled toward the sun, otherwise straight lines are also pulled toward the sun. The beam of light from the hidden star follows the line it "thinks" is straight. Imagine that as I write this, I am actually using Air Quotes around the term *Thinks*. Obviously, photons of light do not think. However, as the otherwise straight lines are warped toward the sun, the beam of light follows that line.



Example #2

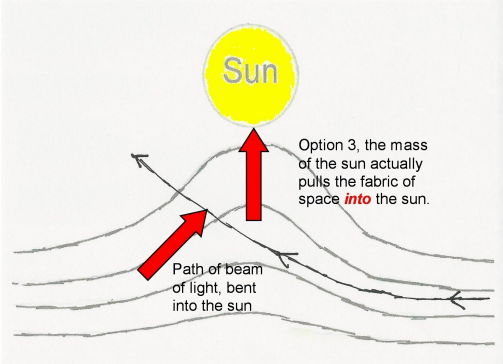
As the beam of light follows the otherwise straight line, it would move inward toward the sun. As it passes the sun, it would move away from the sun and return to the original direction. Therefore, it would not bend around the sun. As a result, with a *static warp,* Eddington *could not* have seen the hidden star.

In the two examples of a static warp created by the mass of the Sun, the light from the hidden star could not have been bent around the sun and Eddington would not have seen the light from the hidden star. But, Eddington *did see the light from the hidden star.* Therefore, the warp from the mass of the sun can *not* be a static warp.

With possibilities #1 and #2 shown to not bend light, let's look at possibility #3.

What happens to a beam of light when it enters a region of an active warp?

What is an active warp and how would it behave?



Light passing through an active warp

In this case, the warp of space into the sun is not simply the bending of the fabric of space inward. The fabric of space is actually *pulled into the mass of the sun*. That is the definition of an active warp.

As light travels through the part of space that is being pulled into the sun. the light still travels in what for it is a straight line. However, that straight line is being pulled along with the space, toward the sun. So, as shown in the diagram, the light from the hidden star can now be seen.

To repeat, the key to the light bending around the sun is that the mass of the Sun *pulls* the fabric of space into it. As the space is pulled into the Sun, anything that is in that region of space is dragged along with the space. So, as shown in the image to the right, as the fabric of the space is pulled into the Sun, the beam of light goes with it.

It's a relatively simple step to take the idea of space being pulled into the sun, and expand it to

the idea that *all* objects with mass, not just the sun, pull the fabric of space into them. The idea that the fabric of space is pulled, not only into the sun, but into all objects with mass, was a real *Ah Ha* moment. That pulling of space into objects is the basis of gravity. After I realized the pulling of space *into all objects* was the only logical conclusion, I began to consider other ideas about gravity.

The logical conclusion is that the fabric of space does move into all objects with mass. And, as the space moves into objects, everything in the surrounding space moves toward the objects.

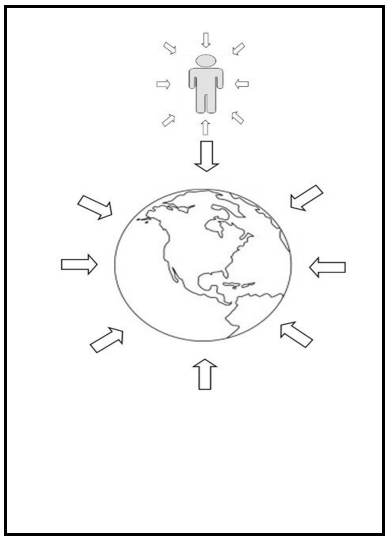
There was a fundamental, a given true statement that fits every bit of information which I had. *All Objects* with mass pull space into them. Once I had accepted that basic foundation, I could base my next views on this one concept. I had a base line. If all objects pull space into them, that is the attraction due to gravity.

With that logical conclusion, I understood the reality of gravity.

- The mass of the sun produces an active warp as space is pulled into the mass of the sun.
- As the fabric of space is *pulled into the sun*, it pulls everything in that region of space, along with it, into the sun.
- Is there something special about the mass that makes up the sun such that only the sun has a gravitational attraction? No. Matter is matter.
- The next logical conclusion is that all mass pulls the fabric of space into it – the Earth, an M1A1 Abrams tank, a person and even a paperclip. All objects with mass attract the fabric of space and pull space into them.

Let's look at examples of a few of these.

The images below indicate how the fabric of space is being pulled into the Earth, a tank, a person and something as small as a paperclip. Any object with mass will pull space into it. So, let's look at how the gravitational attraction between the Earth and a person can happen. To the right is an idealized diagram of space



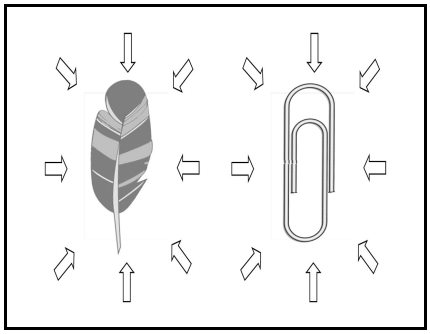
Space pulled into Earth and a person

being pulled into both the Earth and into a person. The mass of the Earth is pulling space and the person into it. At the same time, the mass of the person is also pulling space, and the Earth, into it. The mutual interaction of the Earth pulling the person toward it it and the person pulling the Earth toward it is seen, and felt, as gravity.

A question you are probably asking now is – if objects with mass, even small objects, produce a gravitational attraction, do they produce an attraction between other small objects?

For instance, is there an attraction between a feather and a paperclip? The feather and the paperclip have mass, so the answer is, yes.

As shown in the image to the right, those two objects are pulling space into themselves. Therefore, the feather is pulling the paperclip toward it and the paperclip is pulling the feather toward it. There is a mutual attraction between the two objects, in the same way the Earth and the person attracts each other. The gravitational attraction between the feather and the paperclip is so minor it cannot be noticed due to the overwhelming attraction of everything toward the Earth.



Space is pulled into feather and paperclip

In summary:

4. From the observations of the 1919 Eddington total solar eclipse, gravity is the result of the interaction of the fabric of space being pulled into all objects containing matter.
5. Gravity is not a ubiquitous force that simply exists everywhere.
6. Taking the observation from the Eddington eclipse and thinking about what made sense the conclusion has to be that all objects composed of mass pull the fabric of space *into* them.
7. The attraction of gravity between objects results from the interaction of space being pulled into the bodies of all of objects.

So the key to answering the question - “What is Gravity?” is the action of the fabric of *space*

being pulled into all objects with mass. And everything is pulled along with the fabric of space – light, paperclips and people.

That is gravity - the mutual pulling of space, and all objects in that space, toward each other.

It's the answer to why the apple fell down and not up. It's the reason why Robin Williams tripped and fell and hit his chin.

That is the explanation to what is gravity.

Where does space go?

The logical conclusion coming out of the consideration of the 1919 Eddington observations of the solar eclipse is that the fabric of space is pulled into objects with mass -- *all* objects with mass. As the space moves into the objects, everything in the affected region is pulled along toward the object. That process of pulling everything toward the object is seen as gravity.

One question comes to mind – where does the fabric of space go when it enters an object?

In 1964, the physicist, Peter Higgs, led a team of physicists who proposed the existence of a fundamental sub-atomic particle within the atom. He believed that the particle he sought was the unit of matter that contained all of the mass. Finding the proposed particle became the focus of a good deal of research. In honor of the physicists leading the team, the elusive particle became known as the Higgs Boson, or the Higgs Particle. As an indication of how important the search had become, the particle was given the nickname, *The God Particle*.

Then in July 2012, the announcement came from the Large Hadron Collider (LHC), in Cern, Switzerland. The first evidence of the existence of the Higgs Particle had been found. Exactly how the Higgs contained the mass of an atom was still not understood, however the Higgs had

been discovered.

With the discovery of the Higgs particle, which was said to contain the mass of an atom, it seemed reasonable that the fabric of space would be pulled into the Higgs. It also seemed reasonable that the mass of the object in question resulted from the fabric of space moving into the Higgs.

For the sake of this discussion, I call the unit of mass where space is pulled, The Higgs particle. This determination is speculation, but I needed a name. So, at the time of my writing, the Higgs seemed like the most logical.

But the question then is, where does all of that space go after it enters the Higgs particles? Does all of the space build up in the Higgs?

In order to understand where space goes and why it does not accumulate in the Higgs, I need to discuss the idea of multiverses and the concept of membranes.

There is a field of cosmology which is called Membrane Theory. The concept of a membrane is associated with the science fictionish idea of multiple universes, or multiverses.

What is a Multiverse? In the way that the term ***Uni***verse implies that we live in the *One And Only* universe, the term ***Multi***verse implies that there are many ***Uni***verses.

There are theories about how the different types of Multiverses, how they form and how they play out. The fascinating thing about the different types of multiverses is that each of the different universes would have begun with a version of our Big Bang. As each of the potential multiverses formed, they could be radically different from our universe. Or they could be very similar to ours. Science fiction is filled with tales of different universes from our universe, where everything is the duplicate of ours. In these science fiction universes, there is a duplicate Earth with a duplicate of everyone.

I'll leave those various Sci Fi twists to the science fiction writers. I'm going to stick with the idea of Membranes.

The idea of Membranes is that our entire universe exists on a two dimensional plane, a membrane. The membrane is also called a "Brane."

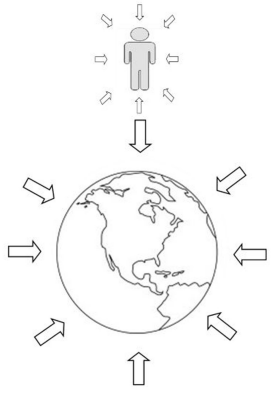
It's difficult for people to get their mental hands around the idea of our entire universe, which stretches in over 14 billion light years in all directions, exists on a single, two dimensional plane. But, the Membrane Theory is one of the most popular of the current cosmological theories.

And since the Membrane Theory allows for the best explanation of the question, where does space go after it is pulled into the Higgs particles. Since it leads to the best explanation of Dark Energy, I believe the Membrane Theory is the most reasonable of many theories.

Back to the question, where does space go?

I believe that as the fabric of space is pulled into the Higgs Particles, it enters the membrane. As the fabric of space is pulled into Higgs particles, any physical objects in that space are pulled along with the it.

The illustration on the right shows space being pulled into both the Earth and a person's body. The result of space being pulled into both objects creates the effect of gravity. And because of that, I am held onto the surface of the Earth with the same force that the Earth is held to the surface of my body.



Space is pulled into both the Earth and a

The question then becomes -- what then happens to the fabric of space after it enters the Higgs particles?

Is a there a location somewhere in the universe, which is associated with the Higgs particles, where space has been accumulating for 14 billion years? That answer is, no! If there was such a situation where 14 billion years of space was vanishing, one of two things would have happened.

1. The total volume of the universe would have been reduced. Or,
2. The volume of space which was vanishing into the Higgs particles would have to be building up somewhere. To date, there is no visual evidence of the accumulated space.

After 14 billion years of space entering the Higgs, where has that volume of space gone?

Explanation:

There is a cycle to the flow of space within the membrane.

- Space is pulled into objects with mass, which are on the membrane. These objects are stars, planets, people and even paperclips.
- The space which enters the membrane is cycled through the membrane until it comes out in different locations.
- The key to the cycle, and the stability of the universe, is the where and how the space returns to the universe.
- The question of where the space goes upon entering the Higgs will be covered in the next section on Dark Energy.

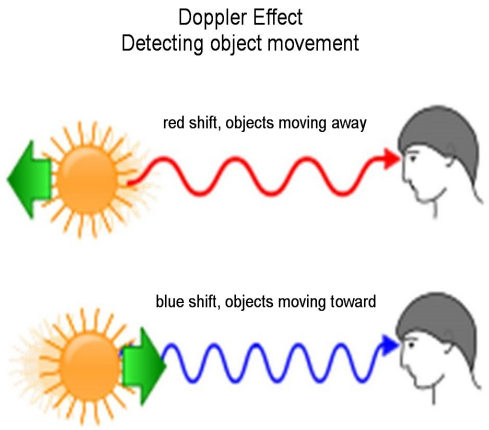
This is where it gets very interesting.

Dark Energy

The term Dark Energy became popular in the late 1990s and is associated with the Big Bang. What is the Big Bang? What is Dark Energy? How do those two ideas relate to each other?

In the 1920s, the astronomer, Edwin Hubble was working at the Mount Wilson Observatory, located in the San Gabriel Mountains, just outside Pasadena, California. In his observations, he noticed that some of the fuzzy spots on his film were actually galaxies. Until then, everyone had assumed that the entire universe was one galaxy, our Milky Way galaxy. Hubble's observation revolutionized the field of astronomy. After establishing the reality that there were many other galaxies, in addition to ours. The universe was suddenly seen to be much larger than had been assumed.

Hubble took his observations further. As he studied the spectrographs of the light from those distant galaxies, he noted that the light from the fainter objects had a significant Red Shift. See the explanation in the diagram to the right.



Doppler shift determining direction and velocity of movement

The shift is due to the Doppler Effect. Objects moving at high velocities away from the observer have a shift to Red. And, objects moving at high velocities toward the observer will have a shift to Blue. Hubble determined that the more the light was Red shifted, the faster they were receding away from us.

What Hubble noted was that the fainter an object, the greater was the red shift. He established the idea that the more distant the object, the greater was the red shift, therefore the faster it was receding from the observer. With time, Hubble established a scale that allowed him to convert the amount of Red Shift in the light from an object, to the distance to the object.

There was an obvious conclusion that grew out of his observations. All objects in the universe were racing away from a central point, and that the more distant they were, the faster they were going. The ultimate conclusion was that with all objects racing away from each other, there had to be a time in the very distant past when everything in the universe was at one point and the expansion began there. That led to the theory of the Big Bang. The name, *Big Bang,* grew out of the idea of the universe beginning with a bang, a very Big Bang.

As an interesting side note, the name Big Bang actually began as a mocking, negative name. British astronomer, Sir Fred Hoyle, was not a believer in the idea of a universe which had a beginning point in time, much less an expanding universe, as proposed by Edwin Hubble. In the 1940s, Hoyle used the name, Big Bang to mock the idea. Much to his frustration, the idea of the expanding universe stuck, and so did the name he'd given it in ridicule.

For decades the idea was that the expansion of the universe, resulting from the Big Bang, was slowing due to the effect of gravity, gradually pulling on all of the objects in the universe. The debate went on – would the slowing go on forever, or would at some point, gravity win out and the universe collapse back on itself in what was called the "Big Crunch?"

After the Big Crunch, there would be, as the theory went, a new Big Bang and a new cycle of expand and contract. The universe would exist forever, expanding and contracting.

As a side note, the idea of a repeating expansion and contraction of the universe fell in line with the Hindu religion of a continual cycle of our universe being born, dying and then being reborn.

In 1998, everything changed.

Saul Perlmutter, an astrophysicist at the University of California at Berkeley, was leading a team seeking to establish once-and-for-all, the rate of the *slowing* of the expansion of the universe.

To everyone's surprise, Dr. Perlmutter's team determined that the expansion was not slowing. Instead, the expansion of the universe was actually *accelerating!* That was an enormous determination. "The expansion of the universe was actually *accelerating!"*

After determining that the expansion was accelerating, they took their observations further and determined that the post-Big Bang expansion of the universe had been slowing until +/- eight billion years ago. At that time, the expansion actually began to accelerate.

After the results of the study were accepted, astronomers had to come up with an explanation for the *how and why* of an accelerating expansion.

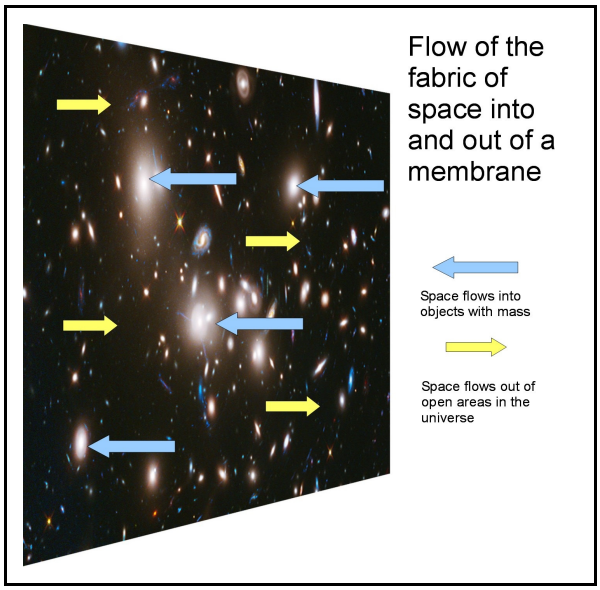
The idea was that there is an unknown force at work. Since anything that is unknown is given the prefix, "Dark," the cause of this acceleration was named, "Dark Energy." No one knew what it was, but at least it had a name.

The idea of Dark Energy really took off. Soon, it became accepted that there was a force "Out There" that was making everything expand. Over time, it was theorized this Dark Energy was going to pull everything apart. One theoretical outcome of Dark Energy was that in the far distant future, not only were galaxies going to be pulled apart, stars and even atoms were going to be pulled apart.

I don't see it like that.

Dark Energy and how it relates to Gravity

The explanation of Dark Energy which makes sense to me, grew out of Membrane Theory. As described earlier, Membrane Theory holds that our entire universe exists on a two-dimensional membrane. While that concept is almost too complicated to handle, Membrane Theory allows for a rational explanation of Dark Energy. So, in a way, I'm actually working backwards to use an outcome to explain the idea of Dark Energy.



Cycle of movement through a membrane

To begin (See image of movement through a membrane):

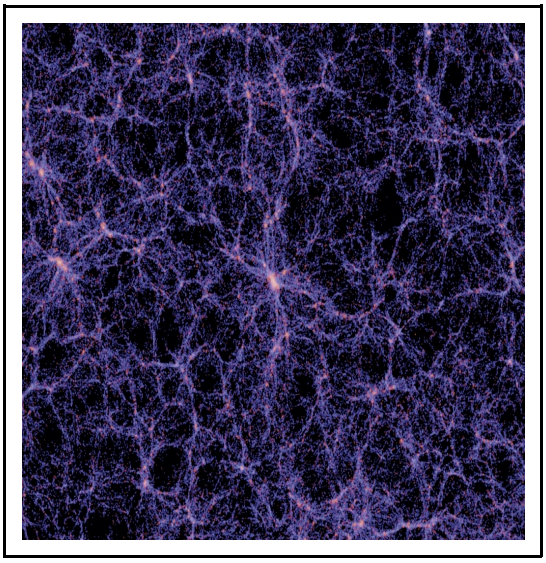
- When it comes to the flow of the fabric of space into objects, there is a cycle to that flow.

- The initial part of the cycle is that the fabric of space flows into objects with mass. As described earlier, that inward flow is part of gravity.
- There is a hypothetical model of how the second part of the cycle, space flowing back into space might work. That second part of the cycle is where space flows out of a membrane and into space. That hypothetical model is that of a White Hole.
- The idea behind the theoretical White Hole is that space flows into one location, into a Black Hole, and comes out in a here-to-fore, unseen White Hole.
- The idea of Dark Energy is similar to that. The image above is an idealized representation of the cycle of space into and out of the membrane.
- Space flows into objects with mass (shown by arrows going to the left.)
- The arrows going to the left represent how after the fabric of space moves through the membrane, it comes back out into open space.

How does this cycle of the movement of space into objects with mass and out into open space fit into the idea of Dark Energy?

To understand Dark Energy and how it has caused the expansion of the universe to accelerate, we need to look at the structure of the universe.

Prior to 1989, it was thought that galactic groups were the largest structures in existence. The thinking also went that these groups, or clusters of galaxies, were distributed uniformly throughout the universe in every direction.



Two dimensional representation of the Web Structure of the universe

However in 1989, that thinking changed. Margaret Geller and John Huchra, using red-shift observations, were able to get locations and distances for celestial objects. They discovered that galaxies were not spread uniformly through the universe. These astronomers found that galaxies existed in a web-like structure. The reason for the existence of the web-like filaments is

still not understood, but the filament structures do exist. The mechanism that caused the filament formation, or what holds them in place, is not fully understood.

Between the long filaments, there are vast open spaces which are completely empty. The size of the open areas are almost too large to comprehend. Rough estimates as to the size of these voids range from 5 billion light-years to 17 billion light-years across. The size of the filaments are estimated to be only 15 million light-years thick.

The image on the right is a two dimensional representation of that filament structure.

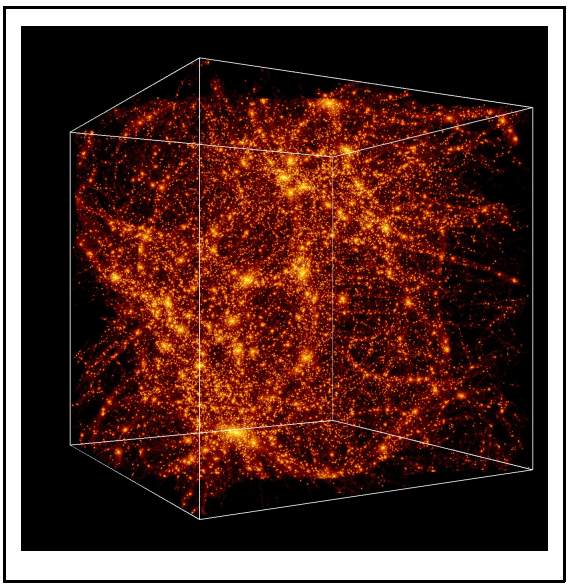
To add a bit of Gee Whiz to the idea of filaments, in the image of the web structures, each of the tiny dots in the filament represents, not a star, not even a galaxy. Each dot represents a group of galaxies - A Group of Galaxies! The size and scale of the web is almost too large to imagine.

So how does the idea of Dark Energy fit in with the web-like structure?

- Relating back to the theory of White Holes, a White Hole is the outlet point for material which was pulled into a Black Hole. The idea is that space enters the Black Hole and moves through membrane until it exits through a White Hole.
- The same concept is thought to apply to Dark Energy.
- As space enters objects with mass, the space is spread throughout the membrane and is evenly released back into the universe in areas which do not contain matter. There is a cycle of the flow of space, into and out of the membrane.
- In regions of the universe where there is roughly an equal amount of open space and objects with mass, there is a balance between space flowing into and out of the membrane.
- With the balance, there is no expansion or contraction. Examples of where this balance exists are within the Milky Way galaxy and the +/- 54 galaxies which make up our local group. Because there is a balanced amount of matter and open space, the Milky Way is

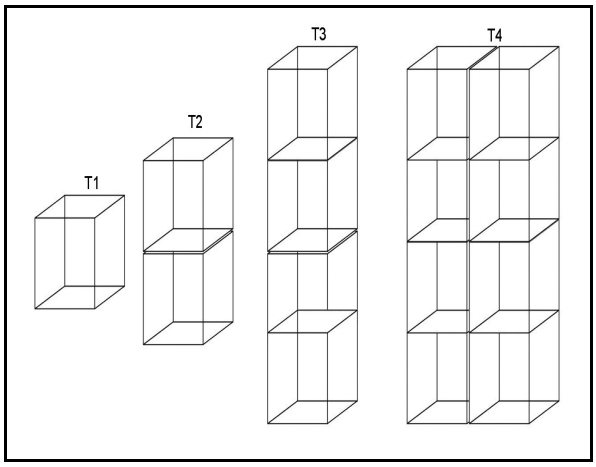
not collapsing in on itself. Likewise, the local group is remaining relatively steady.

- Yes, the Andromeda galaxy is rushing toward our galaxy and the two galaxies will collide in four billion years. However, the movement is due to the random movement within the group.
- On the other hand, the vast open areas where there are virtually no objects with mass, there is no gravity working to balance the outflow of space.
- Refer back to the images of the web-like structure of the universe, to the vast empty spaces. It is in those massive voids where the balance of "into and out of" the membrane breaks down.



Three dimensional representation of the web structure of the universe

- Within the voids, where there are no objects containing mass in the voids, there is no gravity at work to pull space into those missing objects. Therefore, as space flows out of the membrane, into the voids, the voids grow at an ever increasing rate.
- The image below is my concept of how Dark Energy plays out and leads to an ever increasing expansion of the universe.



Creation of space flowing out of the membrane

- At an initial time, T1, there is one unit of space. At time T2, the volume of space has doubled and there are two units of space. By time T3, space has doubled again. Now there are four units of space. By time T4, the volume of space has doubled again. Now there are eight units of space.
- The unknown is how much time passes between T1, T2, T3 and T4. It could be a million years or it could be one year.
- The key is that with the passage of time, when there is no balancing inflow of space due

to gravity, the volume of space will constantly grow, at an ever increasing rate.

That is Dark Energy.

Contrary to some of the speculation about what it is, Dark Energy is not an unknown, all-encompassing energy force that is working to break everything apart. Despite the speculation, in the far distant future, all of the atoms in all of the matter in the universe are not going to be torn apart by Dark Energy. Dark Energy is, for all-intents-and-purposes, the opposite of gravity.

As matter is pulled into the Higgs particles, is there an anti-Higgs that spews out space as the Higgs consumes it?

To summarize Dark Energy and how it relates to gravity:

- Dark Energy is responsible for the recently discovered acceleration in the expansion of the universe.
- Before the discovery of Dark Energy, it was generally assumed that the expansion of the Post-Big Bang universe was slowing due to the slight, but ever present attraction of gravity.
- After Saul Perlmutter's team recognized that the universe expansion was accelerating, the team soon recognized that the portion of the universe which was expanding, was into the enormous voids that exist between the thin filaments in the web-like structure of the universe.
- Something was causing the acceleration. Since it had to have a name, they picked Dark Energy. Right away, Dark Energy took on a mystical aura. It was seen as an all pervasive field that was working to pull everything apart. According to some, in the distant future, Dark Energy might pull the atoms of the universe apart.
- Dark Energy is the second half of a cycle of – Gravity/Dark Energy. As gravity pulls space into objects, the space moves out of the membrane and out into open space.
- Since the vast majority of empty space exists in the large voids between the web structures, that is where the majority of space is being extruded from the membrane.
- Space is created in the voids. As more and more space is created in the voids, the voids

grow larger and larger.

- That is the mechanism by which the expansion of the universe accelerates.
- It is that mechanism, not a mythical energy field, that is the key to the acceleration.

Gravity taken to the extreme - Black Holes

In a previous section, we saw that the 1919 Eddington observations of a total solar eclipse showed that objects with mass produce an active warp in the space surrounding those objects. The warp is the result of the fabric of space being pulled into the mass.

Object #1 pulls object #2 toward it. At the same time, object #2 is pulling object #1 toward it. The combined mutual pulling, one on another is the gravitational attraction between those two objects.

There is an interesting phenomenon that occurs when a star dies. At the end of its life, the star's nuclear reaction stops. It is the nuclear reaction that produces the outward pressure. With the outward pressure gone, there is no longer a countering force to the inward gravitational pull of the star material. When that happens, the material in the star falls back in on itself. The result is a total collapse of the core. At that point, the core becomes so dense, its gravity takes over and the star continues to collapse.

When the pre-collapse star is eight solar masses or more, the end result of the collapse is a Black Hole. The total mass of the star is concentrated into an infinitely small particle, a particle that could be smaller than an atom.

The super dense center, smaller than the nucleus of an atom, is the Singularity.

The density of the singularity is so great, and the resulting gravitational pull is so strong, that nothing, not even light, can escape. (Since no light escapes, it is called a Black Hole.) Again, the theory is that the gravity from the singularity pulls the photons of light back into the Black

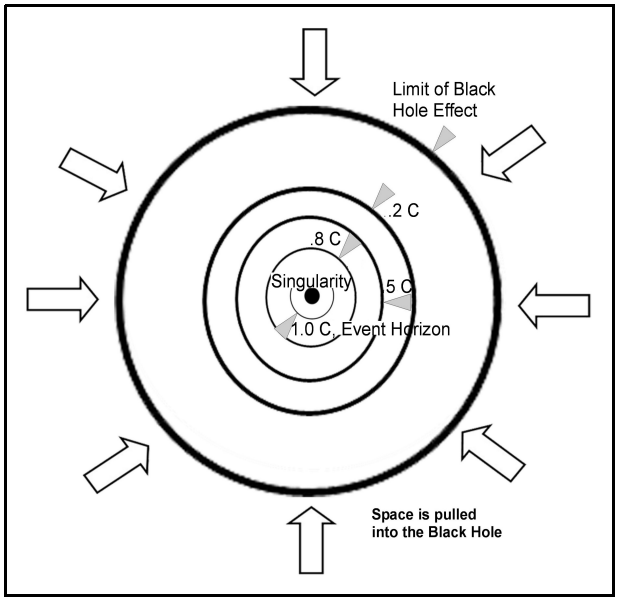
Hole.

Again, referring back to the 1919, Eddington solar eclipse, since photons are massless, they cannot be directly influenced by gravity. There is no mutual gravitational attraction between an object and a photon of light. So, why does light not escape from a Black Hole?

The answer to that question is the same as the answer to why Eddington could observe the star which was located behind the face of the sun. In 1919, Eddington could see the star because the fabric of space was pulled into the mass of the sun. As space was pulled inward, everything that was in the space, even massless photons of light, moved toward the sun.

As with the nearby space being pulled into the sun, in a Black Hole, the enormous mass of the Black Hole, many times more massive than that of the sun, pulls space into it.

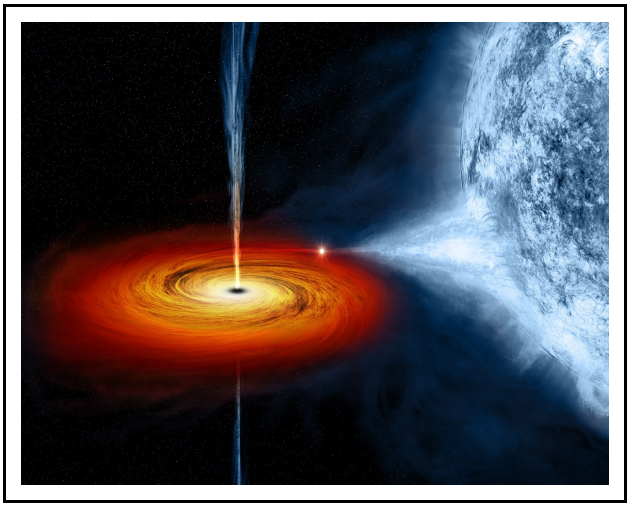
As seen in the cross-section of a Black Hole, the fabric of space is pulled into the Black Hole, down toward the singularity. At a point, going from a great distance to being near the Black Hole, space begins to "feel" the effect of the Black Hole. At that point, space begins its inward trip, toward the singularity. The farther downward toward the heart of the Black Hole, the faster space is being pulled into the singularity.



As seen on the accompanying diagram, going inward, the velocity of space moving toward the singularity reaches .2 C. (C is the symbol for the speed of light. C = 186,000 miles/sec.) Still nearer to the singularity, the speed of space being pulled inward has increased even more. At a point, the velocity of space being pulled inward reaches .5 C and then .8 C. When the speed of space being pulled inward reaches, C, the speed of light, that is the Event Horizon.

Inside the Event Horizon, the speed of space moving inward, toward the singularity either continues to accelerate past C, or it maxes out at C. Einstein's Theory of Relativity holds that nothing can move faster than the speed of light. Does that hold for what happens inside the Event Horizon? No one knows. Either way, light cannot escape from the Event Horizon because as it moves outward through space, space is moving inward at the same speed or faster.

What happens to light after it passes through the Event Horizon is very much like the diagram on the right. Imagine a person walking up an escalator at 4 miles per hour. If the escalator is not moving, he will proceed upward at 4 miles per hour. However, if the steps on the escalator are moving downward at 5 miles per hour, no matter how long the person walks up the escalator at 4 miles per hour, he will not reach the top.



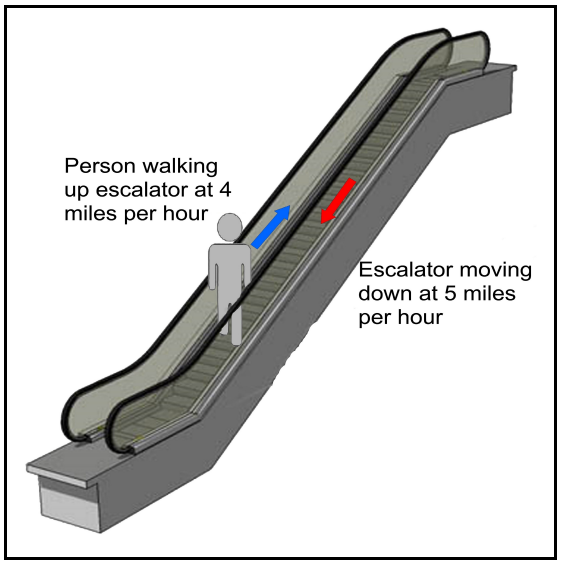
Artist conception of a Black Hole feeding on material from an adjacent object

The accepted idea that the gravity of a Black Hole pulls light back into it is wrong. As was detailed earlier, gravity cannot affect light. The logical conclusion is that as light within the Event Horizon is moving outward at the speed of light, it cannot reach the Event Horizon, or beyond, because space is moving inward at a speed faster than the speed of light.

Since no light can escape, it is dark to the outside universe. Hence the name, Black Hole.

Again, for the physicist purest, Yes, Black Holes can be seen, but only when they are "Feeding."

As in the illustration above, feeding occurs if a star or a nebula gets too near a Black Hole. When that happens, the material from the star or the nebulae is pulled into the Black Hole. At that point, the



Relating movement on escalator to light within an Event Horizon

material being pulled in is heated to unbelievably high temperatures. That material glows with a very bright light and the Black Hole can be seen..

However, that is a different topic and is not considered here.

Summary

What you have read is my ideas of gravity, what it is, how and why it behaves as it does.

This idea, and the concepts which followed, are my heart-felt beliefs. They grew out of a feeling which began in the 5th grade. Then, in 2005, I reached the point where I was thinking of this idea quite a bit. At some point, I had to get these ideas put down on paper.

I tried to use as little math as possible, however there were portions that required a limited amount.

I began with the proposition that didn't sit well with me back when I was in the 5th grade. The problem concerned the question of falling objects. Once I understood that objects only *seem* to fall at the same speed, I moved on to try to understand exactly what is gravity. That quest began with a consideration of the 1919 Eddington observation of the total solar eclipse. From those results, I reached a logical conclusion as to the nature of gravity.

Then based on that conclusion, I built on to it, always taking my logical conclusion as the basis of the next step. I moved in that fashion, until I reached another logical conclusion.

Building, point-onto-point, I expanded my discussion. At some point, as a reader, you may feel I reached too much into the realm of physics speculation.

Believe me or don't believe me or believe a portion of it. Either way, feel free to drop me an e-mail and let me know what you think. You can reach me at – ***wkerch@comcast.net***

I hope you enjoyed reading my ideas as much as I have enjoyed putting them to paper.