

Unlocking: Dark Energy and Dark Matter

By Jayant Kapatker

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Both Dark Energy (DE) and Dark Matter (DM) are an unsolved mystery. Because they are undiscoverable, they are called 'Dark'. Scientists know Dark Energy and Dark Matter exist because without them, the universe cannot sustain itself or function in its current form.

With powerful telescopes, scientists have been watching the universe. They have discovered a lot. They have a good idea of the number of galaxies, and the number of stars and planetary systems within each galaxy. Watching the expansion of the universe and movement of these galaxies, they have estimated the energy composition of the universe to be:

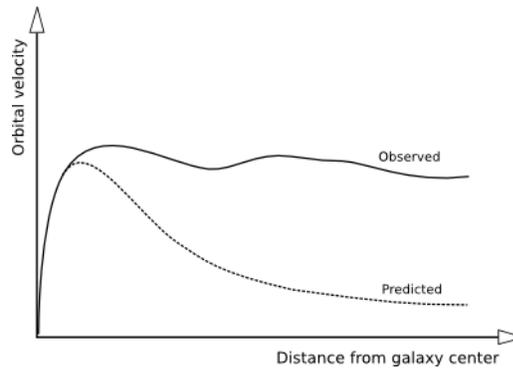
- Dark energy (DE) – 79%
- Dark matter (DM) – 26%
- Visible Matter – 5%

The visible galaxies and the stars and planets within them make up 5% of the energy. The balance 95% energy is unknown, and scientists believe it is made up of DE and DM. Why? They believe that DE and DM are necessary for the universe to function. Here is a current understanding of dark energy and dark matter.

Dark Energy: Cosmologists know there is a gravitational pull between the galaxies, which means that the galaxies are pulled closer to each other. So, the space between the galaxies should contract as the galaxies come closer to each other. Observation has shown that this is not happening. Instead, what is seen is that space is expanding, and the galaxies are moving apart. The only way this can happen is if there is some force which is pushing all the galaxies apart. We can deduce that this force is greater than the gravitational pull and is the reason for the expansion of space. This expansionary force requires energy, lots of energy. This energy is the mysterious Dark Energy, which is responsible for the expansion of the universe. Scientists estimate Dark Energy makes up 79% of the total energy requirement for this universe. This Dark Energy is unknown. They have no clue about its composition. It is not like visible energy. It is not gamma rays, x-rays or any other electromagnetic waves, which make up the spectrum of visible energy. Researchers are looking for DE, but it continues to be unknown.

Dark Matter: If you follow science, you will know that each galaxy rotates around its center. The center is usually a massive black hole. All the stars and planets within a galaxy rotate around its black hole. This also applies to our Milky Way. Earth, part of the solar system, rotates around the sun. Our solar system including the sun, rotates around the center of the Milky Way. Fun fact – it takes 228 million years for our solar system to make one complete round of the Milky way. Just imagine - they were dinosaurs on Earth when our solar system was last at its current location.

When scientists look at the rotation of these galaxies, they find something strange which is inexplicable. The orbital speeds of galaxies do not follow the physical laws found in other orbital systems such as stars, planets, and moons. Stars and Planetary systems revolve around their galaxy's center at equal or increasing speeds over a large range of distances. In contrast, the orbital



speed of planets within their planetary systems declines with distance. For example, in our solar system - the orbital speed of Pluto is much lower compared to other planets in the system. This decrease in orbital speed as distance increases is proven by calculations. This logic does not apply to stars and planetary systems in galaxies. As the graph above shows, as the distance from the center of the galaxy increases, the orbital speed of observed objects in the galaxy is much higher than what is predicted by scientific calculations.

This increased orbital speed of objects in a galaxy has many implications. The high rotational speed of objects at the outer edge would mean that they should not and cannot rotate around the galaxy but should escape or fly out. They are rotating so fast that they should escape their orbits. But this is not what is observed. Why this contradiction in physical laws? No one has yet been able to figure this out. It is a mystery. Scientists have postulated that there is additional matter around these stars. The increased matter in the galaxy means that there is an increased gravitational pull to the center. This allows the stars of the outer edge to maintain their rotation in their mother galaxy. Scientists do not know what this additional matter is and so it's called Dark Matter. Scientists estimate that DM makes up 26% of the total available energy in the universe.

There is an increasing effort scientific circles to find Dark Matter. Scientists think dark matter must be made up of particles. Initially, they thought it was like visible matter, made up of protons, neutrons and electrons and an array of sub-atomic particles. Atomic particles interact with light and other electromagnetic waves. After a series of experiments, scientists are finding that dark matter does not interact with light and other electromagnetic waves. There is no absorption or reflection of light. So, the conclusion is that Dark Matter is not the same as visible

matter. It is something different, it is something unknown. To continue the search, a wide range of unique experiments are being conducted in various parts of the world to discover the particles which make up dark matter. In one high profile experiment, a tunnel has been dug one mile underground to make sure no earthly particles can pass through. In this tunnel they are hoping a dark matter particle will show up so that they can then study its properties.

Will they be successful? I believe it to be unlikely. They are not going to find dark energy and dark matter in space out there. They have already tried and failed to find DM and DE within the visible matter. The time is come to look elsewhere.

Going back to Einstein's theory of relativity, we get a clue. In this theory, Einstein made a connection between space and time. He stated that space and time are two sides of the same coin and he called this the spacetime. He also stated that this spacetime is like a fabric made up of time and the entire universe rests on this spacetime fabric.

Since we have seen that scientists are unable to find dark matter and dark energy in space, I believe that to understand them, we need to properly understand time based spacetime fabric. If they shift their focus and attention to the spacetime fabric, they will find answers to dark energy and dark matter.

In this article we are going to focus on spacetime and show how a better understanding of spacetime can lead to unlocking the mystery of dark energy and dark matter. Before we move forward, it is important to fully understand the following key issues.

- Spacetime vs Space
- Framework of the Time Fabric
- Einstein's Theory of Relativity

Spacetime and Space

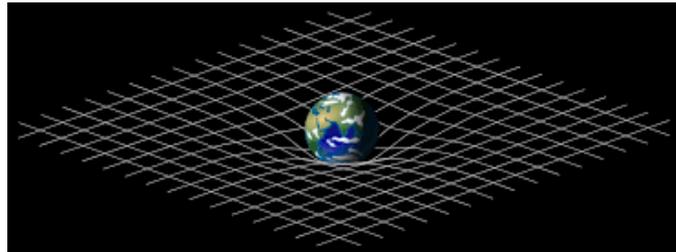
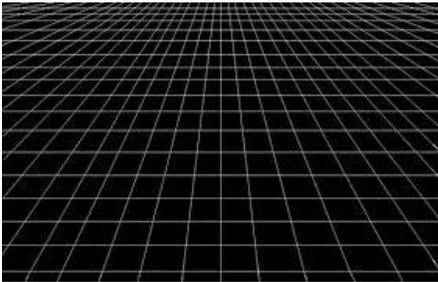
As mentioned earlier Einstein coined the term spacetime. This term causes some confusion. There is space and there is spacetime. What is the difference? Space is what we see out when we look out and everything in space is measured in distances. The tree is 200 feet away; the plane is flying at 30,000 feet. Space is visible and operates in the 3 dimensions.

Spacetime looks at the same 'thing' in terms of time. This term is confusing because there is no space in spacetime there is only time. In spacetime the measurement is in units of time alone, no distances are measured. For example, light takes 8 minutes to reach us from the sun, the distant star is 500 million light years away. Everything in spacetime is measured in time only. There is NO distances etc., only time. The following images will help in understanding the spacetime Fabric, but they wrongly convey the impression that the spacetime Fabric operates

in space. This is wrong because spacetime operates in a different plane. As Einstein stated, spacetime operates in the 4th dimension. Where is the 4th dimension? One thing is clear that the 4th dimension cannot function in the 3 dimensions, otherwise we would have to say that space has 4 dimensions.

Henceforth in this article we will refer to spacetime as Time Fabric to avoid the confusion created by the term spacetime. This is more accurate and conveys the meaning that only time is the variable in spacetime.

Spacetime Fabric = Time Fabric



Nobody knows where the 4th dimension is. We could speculate, but the location of the 4th dimension is not the focus of this article. We will show later that energy interacts with the Time Fabric to create space. Understanding the Time Fabric is the key to unlocking the mystery of dark energy and dark matter.

Framework of the Time Fabric

If you look at space, it is impossible to find a starting point or even the edge of space. Space is everywhere. But for Time Fabric there must be a start and end point. Why? Because Time Fabric is made up of time. Time must have a beginning and an end.

Where is the starting point for Time Fabric? $t = 0$ must be the starting point for the Time Fabric. We know the big bang happened about 13.7 billion years ago. We also know time started with the big bang. Before the big bang there was no time. Does that mean that the starting point of Time Fabric occurs at the advent of the big bang? The big bang is no longer the start point or the $t = 0$ location for the fabric. Science really confuses the issue by saying the Time Fabric starts with the big bang. Yes, time started 13.7 billion years back, but at this current moment, at this now moment, the $t = 0$ for the Time Fabric is **not** the big bang. The big bang is the outer edge or ending point of the Time Fabric.

If not the big bang, where is the start point ($t=0$) for the Time Fabric? To understand the $t=0$ point for the Time Fabric, let us visualize the space in terms of time.

Let us study the external objects 'out there' in terms of time. If we can see a faraway star, say 5 million light years away, it takes light from that star 5 million years to reach us. Now, we see the sun, the light from the sun takes 8 min to reach us. We look at the moon; its light will take 3 seconds to reach us. We look at the plane flying in the sky, at 30,000 feet; its light takes about 300 milliseconds to reach us. As the distance of the object being viewed is reduced, the time taken for light to reach us is much smaller. I now look at the tree outside the window; the time taken for light to reach me is 10 microseconds (10^{-6}). For instance, I am looking at the computer screen 1 ft away typing this article, then light will take about 1 nanosecond (10^{-9}). As the distance reduces the time taken for light also reduces. If you extrapolate this backward, the only logical place for time to be equal to 0 is the observer, who is watching all these objects. This means that the observer within you is the starting point of the Time Fabric. This is the $t=0$ of the Time Fabric. This means that the Time Fabric starts with the observer within you.

Where is the end point for Time Fabric? If the start point for the Time Fabric is the observer within you, where is the end point? This is simple, since the universe is 13.7 billion years old, the end point of the Time Fabric is 13.7 billion years away from you. In the 4th dimension, which is made up of time, the Time Fabric extends from the observer within you to the big bang moment.

Is the end point static? Obviously, not. As time moves forward, the Time Fabric will keep expanding. The size of the Time Fabric is directly proportional to the time elapsed. Right now, if the universe is 13.7 billion years old, the size of the Time Fabric is 13.7 billion years. After 1 year, the size of the Time Fabric will be 13.7 billion years + 1 year. In other words, the outer edge of the Time Fabric expands as time goes by.

Construction of Time Fabric: Logically you would expect the Time Fabric to be continuous. The images shown earlier, shows the fabric is not continuous but it constitutes a grid with discrete nodal points. Why? This is because time is not continuous. The time does feel continuous, but it is not continuous. Based on the Plank Constant, it is proven that time is made of discrete elements. The shortest separation between two discrete elements is 10^{-44} seconds. These discrete time elements make up the Time Fabric. The start of the Time Fabric is the $t=0$, which is the observer within you. The first node will be at 10^{-44} sec away from the observer. The second node will be at 2×10^{-44} sec away, the third node will be 3×10^{-44} away. With these small increments of time nodes, the entire Time Fabric is built up. 10^{-44} is a very small value. The human mind cannot even comprehend this. Can you imagine the number of time nodes in the fabric to reach the sun which is 8 min away or to a faraway star which is 5 million light-years away?

Einstein's Theory of Relativity

To connect space and the Time Fabric properly, it is important to understand the Einstein's theory of relativity. In 1905, he postulated the theory of special relativity and in 1915, he introduced the theory of general relativity. Let us discuss each one of them to make the connection between space and Time Fabric.

Theory of Special Relativity:

Without going into details, one of the major conclusions of this theory is that time and motion are interconnected. Put simply, wherever there is motion time slows down. Yes, time does slow down with motion. Your clock will slow down. The faster you go, the slower time becomes. You may not notice it, because the change is exceedingly small, but time does slow down. At the speed of light (186,000 miles per sec) time does not move and it becomes standstill. This connection between motion and time is a proven fact.

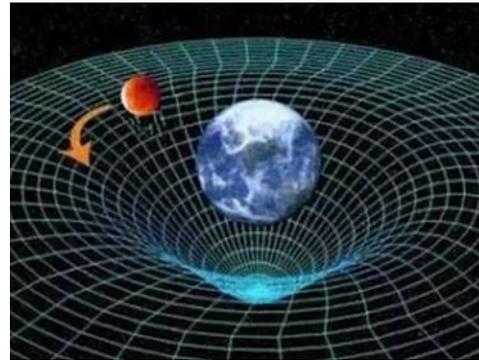
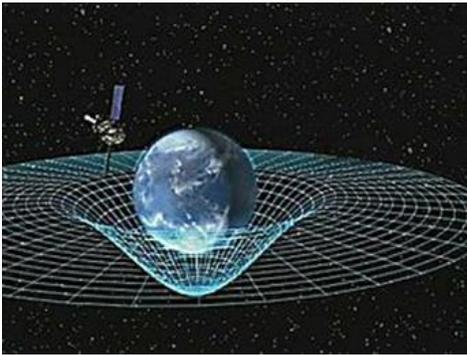
If you think about it, motion operates in space (in the 3 dimensions) and time with the Time Fabric (in the 4th dimension). So, space and the Time Fabric are connected. Science believes that motion is the cause and the effect of that motion is the change in the Time Fabric. What is the change in the Time Fabric? Slowing down of time means that the Time Fabric is more compressed. The time nodes in the fabric are closer, they are more compressed. The higher the speed the closer the time nodes in the fabric. At the speed of light there is no time, there is no Time Fabric.

Science believes motion happens first, and this slows down time. Motion happens in the 3 dimensions and the time change happens in the Time Fabric (the 4th dimension). Is this the correct way to interpret the theory of special relativity? Another way to look at this interconnection is the reverse - time slows down first and this causes motion. Compress the Time Fabric and motion happens in space. This is opposite to the conventional thinking. Which is correct? We are so used to conventional thinking that it is be difficult to accept that compression of the Time Fabric causes motion.

We will see later that to decode dark energy and dark matter; it is important to study the Time Fabric. We will see that dark energy and dark matter operate within the Time Fabric. The cause of dark energy and dark matter is in the Time Fabric and the effect of is seen in space. Everything happens first in the Time Fabric and not in space. Even the motion of planets and stars is only due to the compression and decompression of time in the Time Fabric. Understanding this will help find the mystery behind dark energy and dark matter.

Theory of General Relativity (GR):

Einstein introduced the theory of General Relativity in 1915. The major outcome of this theory is that in the presence of matter, time slows down. The slowing down of time is represented by the Time Fabric bending or curving around an object. The heavier the mass, the greater the curvature. Not only planets and stars, but matter with any mass will slow down time and curve the Time Fabric. For objects with a very small mass, the curve will not be noticeable.



The above image, placing a planet (or any other object) on the Time Fabric is a good way to understand the curving of the Time Fabric. However, is this image accurate. No, it's not. Why? Planet is matter and functions in the 3 dimensions of space. The Time Fabric is in the 4th dimension. There is no place for matter in the 4th dimension. Matter cannot exist in the 4th dimension. So, what is the alternative? We know energy and matter are connected by the famous equation $E = mc^2$. So, it is the energy profile of objects which is available in the Time Fabric and not matter. So, in an image like the one above, where they show an object dipping down into the curve, it must be understood it is the energy profile of the object and not the physical object itself. This applies to every small and every large object in the universe.

Around the curvature, there are horizontal and vertical timelines. It is important to understand these timelines:

Vertical Timelines: The vertical timelines in the curvature are the source for the rotational or orbital motion. How can we say this? In the earlier section we showed that Time Fabric and motion are connected. The speed of rotation would depend how close or apart the vertical timelines are in the Time Fabric. The more compressed the vertical timelines, the higher the orbital speed. Vertical timelines are the cause for planetary orbital motion.

If you study the curvature around any massive object, the vertical timelines would be further apart at the top and more compressed at the bottom of the curvature. What does this mean? This means that wherever the vertical timelines are more compressed, the orbital speed of objects would be higher. Therefore, the orbital speed of objects near the bottom of the curvature would be higher than the orbital speed of objects at the top of the curvature.

This is what physicists predict with their calculations. In our solar system Mercury (closest to the sun) rotates faster than Earth and Earth rotate faster than all other planets in the solar system. Pluto, which is furthest away, is the slowest. We see that the compression of the vertical timelines complies with observed facts and calculations regarding the solar system.

Horizontal Timelines: The curvature of the Time Fabric is mainly due to the horizontal timelines. These horizontal timelines are the source for gravitational pull. The horizontal timelines in the images above do not faithfully represent the exact format. These horizontal timelines should follow a squared function graph. The top horizontal timelines should be more spaced out and as we move down the curvature, the timelines should be more compressed. This curvature should follow the t^2 function. Why? Gravity is a function of t^2 . As time increases the speed of objects increases in a squared manner. The horizontal timelines in the curvature should reflect this.

Let us imagine an object rolls down this Time Fabric. From the earlier discussion we have seen that the Time Fabric is the cause for the motion of objects. At the top, the separation of the horizontal timelines will determine initial speed of the object. As it moves further down the slope of the curvature, the timelines are more compressed following the t^2 function. This means the object will gather speed following the rules of gravity. With the curvature, the Time Fabric is providing the framework for the gravitational pull in space.

Before we continue, let us once again review some key aspects of the Time Fabric:

1. Time Fabric is made up of time and functions in the 4th dimension.
2. The starting point or $t = 0$ of the Time Fabric is the observer within you. The end point is the big bang.
3. As time flows, the Time Fabric will keep expanding.
4. The compression and expansion of the Time Fabric is the source for motion and gravity/acceleration.

With this understanding, let us see if we decode the mystery behind Dark Energy and Dark Matter

Understanding Dark Energy

The Time Fabric (the 4th dimension) creates the space which you see all around. How? To create space from the Time Fabric, there must be an energy source. Unfortunately, little is known about energy. How is it created, where is it created? These are unanswered questions. We know energy is used to make visible matter. We don't know the source of this energy. It will not

be incorrect to guess that somewhere there is an exceptionally large reservoir of energy. In fact, it could be an infinite source of energy. It would seem this energy plays different roles. Visible matter is created by this energy source. Let us see what happens when a part of this energy interacts with the Time Fabric. This energy stretches out time, so that every second in time is equal to 186,000 miles (speed of light). Just like a rubber band can be stretched outwards, in the same way, Time Fabric is being stretched outwards by this energy. With this stretching of the Time Fabric, space is created. One second of the Time Fabric becomes 186,000 miles of space. This is the space we see. Therefore, we see that space is created when energy stretches out the Time Fabric. From the big bang to today, there are 13.7 billion years of the Time Fabric. The entire Time Fabric is stretched out by dark energy to create the space for the visible universe out there. A great deal of energy is required to stretch out the entire Time Fabric. This energy requirement for stretching the Time Fabric is nothing but dark energy. Scientists have estimated that dark energy is about 79% of the total energy requirement for this universe.

This energy which can stretch the Time Fabric is Dark Energy. It is not your ordinary energy, which is part of the visible universe. Dark energy is not part of the electromagnetic spectrum. The electromagnetic energy is good for visible matter, but it cannot stretch the Time Fabric to create space. To discover dark energy, more investigation must be done to understand the Time Fabric.

1. Does the compression of the Time Fabric change the size of space we see outside? No. There may be no compression, little compression, moderate compression, or extreme Time Fabric compression. In all these conditions, the dark energy will continue to expand one second of the Time Fabric to make 186,000 miles in space. The size of space will always be 186,000 miles per second irrespective of the level of Time Fabric compression. Compression or no compression, the dark energy will always stretch one second of the Time Fabric to 186,000 miles. We know light travels at 186,000 per second. Light travels at this speed because one second of the Time Fabric is stretched to 186,000 miles. So, speed of light will always remain constant, irrespective of how slow, or fast time moves. This is the major finding of the Einstein theory of special relativity.

2. We have seen earlier that as time flows, the Time Fabric will keep expanding. This means that the dark energy will stretch the Time Fabric to create an ever-expanding space out there. As long as time flows, space will continue to expand. More and more of the dark energy is being used to continue the expansion of space.

Understanding Dark Matter

We have seen earlier that scientists believe the existence of dark matter because the orbital speed of stars/planets in the galaxy is much higher than what is predicted. Because of this high speed, scientists believe there is dark matter around these stars/planets, which is holding these planetary objects in the orbit. Without this dark matter, the planets/stars would escape the orbit of the galaxy.

So, what is this dark matter? Let us go back to the Time Fabric. We have seen that when the energy profile of an object is placed on the Time Fabric, it curves the Time Fabric. As, we discussed earlier, the vertical timelines in the Time Fabric provides the orbital speed to the objects and the horizontal timelines provides the gravitational pull of the object to the bottom of the time curvature. Physics has a standard way of calculating the orbital speed depending how far the object is from the center of the orbit.

Looking at these planets/stars in the galaxy, scientists have discovered that the orbital speed of the objects is much higher than what it logically should be. Why is the speed of these objects higher than what it should be? Nobody really knows. A good guess would be that this orbital speed is required to maintain the structure of the galaxy. Without the higher orbital speeds, the galaxy cannot hold itself together. It will fall apart. Everything is precise in nature, so this increased orbital speed is required to maintain the galaxy as one unit.

Based on the standard calculations, the orbital speed of objects must have a certain value, depending how far the object is from the center. However, we see the speed is much higher. How does the object increase its speed? The object cannot increase its speed on its own. The only way to increase speed is to compress the Time Fabric around the object. Compressing the Time Fabric means that time slows down. We know from the theory of special relativity, when time slows down, the speed of the object increases. You may ask the question, who compresses the Time Fabric to increase the speed of the object? This is not an easy question to answer. Like so many other things, nature has the intelligence to compress the Time Fabric to slow down time. This slowing down of time, increases the orbital speed of the object.

The slowing down of time in the vertical timelines also affects the horizontal timelines. Time slows down in the horizontal timelines also, and they become more compressed, just like the vertical timelines, but in this case, it is the acceleration which increases. This happens because the horizontal timelines follow the t^2 function. This increase in acceleration and therefore, in orbital speed, means the gravitational pull is much stronger on the orbiting object.

Another effect of the slowing of time and increase in the gravitational pull is that the slope of the curvature of the Time Fabric will also change. This change in the slope will mean the curvature of the Time Fabric will be much deeper than what it should be. This is a key point to understand and remember.

The energy profile of the object or object energy will bend the Time Fabric and create a certain curvature. The slowing of time and increase in the speed of the of object, creates a much deeper curvature. The object's energy does not fill up the deeper curvature of the Time Fabric. This area in the Time Fabric cannot be left empty. The gravitational energy which interacts with the Time Fabric fills up the balance of the curvature. So, the deeper curvature of the Time Fabric that is created contains both the object's energy and gravitational energy.

Time Fabric Curvature Energy = Object Energy + Additional Gravitational Energy

When dark energy is stretching Time Fabric to create space, the object's energy is converted into visible matter and the additional gravitational energy is converted to dark matter. So, dark matter is the direct result of the additional gravitational energy which is required to maintain the enhanced rotational speed of the object.

Dark matter is available in all parts of the universe, where the orbital speed of planetary objects is higher than what the physical calculation will show. Scientists have estimated dark matter makes up 26% of the energy requirement in this universe.

If you want to find and understand dark matter, it is important to study the horizontal timelines in the curvature of the Time Fabric. The change in slope of the horizontal timelines in the Time Fabric directly results in the creation of gravitational energy. This gravitational energy is the source of dark matter.

So, in conclusion we can say that the mystery of dark energy and dark matter can be solved if a better understanding of the Time Fabric is gained. Science should focus its attention on the study of the Time Fabric, which operates in the 4th dimension.