Bi-verse theory

Sreeram Pozhat Menon

September 2023

1 Abstract

In this theorem titled bi-verse, we aim to provide a unique mathematical explanation for the current nature of the universe. By conceptualizing the world as a thread, we introduce a novel approach where particles are generated due to the oscillations of this thread. This paper sets our work apart by offering a new framework that diverges from traditional theories about the nature of universe.

2 Introduction

Background: The universe's expansion and the big bang theory are well-documented phenomena [2]. Current theories suggest that particles or clusters of galaxies are moving away from each other at an accelerating rate, raising concerns about a 'cold death' for our universe [4]. While existing models offer some insights, our research aims to fill gaps in the understanding of dark energy and other unresolved issues.

3 Explanation of World Model

Note: The above image is a conceptual representation and is not used in our mathematical calculations. It is included to provide an intuitive understanding of the theory.

This theory posits that our world—far from being a singular 'universe'—is at least a bi-verse, formed due to the oscillations of a fundamental string. These oscillations are theorized to give rise to mass and particles in our universe. The complementary universe to ours exists in a time-space verse and is interconnected through what we term as "stop holes," analogous to black holes in our space-time universe.

Our model suggests that an event in the time-space verse led to the formation of our space-time verse through a big bang.

Imagine a horizontal string existing in an empty verse. This string experiences curvature and motion due to its own mass acting on it. The curvature increases until it reaches the maximum denoted by its amplitude. At this point,

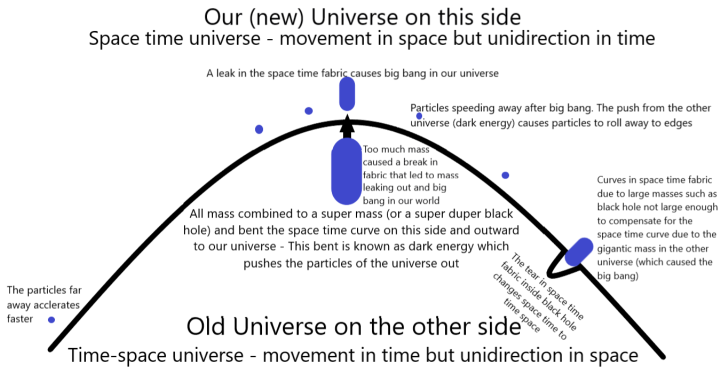


Figure 1: Visual representation of the Bi-verse theory. The figure illustrates the interaction between the space-time and time-space verses through stop holes which leads to big-bang.

the potential energy of the string reaches maximum which sets the stage for events akin to a kugelblitz.

4 Definitions

Blackhole – Massive object or a portal that changes the ordinary behaviour of time and space in our universe that is expected to push the particles from our universe through the string to the other side of the string.

Epicenter – The center of the thread. For visualization, this can be seen as the point where the entire particles in one universe tend to get accumulated during crusts and troughs to form a structure that is maximally massive.

Big bang – Event of tearing the fabric, particles flowing out into other universe, and curve of sheet changing direction.

Hubbles constant - The rate at which the particles at distance in the universe move away from the observer.

Zero point – The points in the fabric and not in either side of the diverse. This is the point where both the universes perfectly balance each other and crossing this point is said to be the 'tearing' of the fabric. At the zero point, space and time is expected to be equally unidirectional or non-existent. This is also called as singularity.

A kugelblitz - is a theoretical astrophysical object predicted by general relativity. It is a concentration of heat, light or radiation so intense that its energy forms an event horizon and becomes self-trapped. In other words, if enough radiation is aimed into a region of space, the concentration of energy can warp spacetime so much that it creates a black hole. This would be a black hole whose original mass–energy was in the form of radiant energy rather than matter, however as soon as it forms, it is indistinguishable from an ordinary black hole.

Maxiholes – To make the visualization about particles being created easy for the reader. While, we don't strictly need to define maxiholes for our paper, this terminology makes it easier to understand the initial proposal before getting into the mathematics. The term denotes the maximally massive structures that gets created at the epicenter on either sides. This can be a black or a white hole depending on the side of tearing. This is different from usual or even supermassive black/white holes, as maxiholes have almost all particles of the diverse with it. The term mass is avoided here, as mass is connected to space and there could be equivalent term in time verse. Similarly, the term black is avoided as it is also connected to space and equivalent term for time verse is stop. Actually even the word hole (or bang) is not apt, as it is connected to space. But then, the term might not be readily understood by the readers.

5 Assumptions

Our primary focus is to understand the behavior of the string leading to the big bang and its implications for particle motion in the current universe. For the purpose of this paper, we assume the universe as a long string or thread of space-time continuum. We recognize that this assumption may be non-intuitive, and thus we provide extensive mathematical justification in the subsequent sections.

Imagine the di-verse as a long thread of space-time continuum. The thread has two sides (like a coin or a sheet). One side of the thread is space-time continuum, which is our universe or the mirrorverse, and other side is time-space continuum, which is the universe in question, seen as the original verse. The thread, when flat and without vibrations, has no distinction between both, and has similar properties at both sides, as in the singularity. Hence the thread might very well be a long thread of singularity.

Before we analyse the nature of the infinitely long thread and the dimensions in the time-space verse, we will make the following assumptions to simplify the mathematical model.

1. Thread exists in a world devoid of all matter except the thread itself. There is no external force on the thread.

2. We are taking newtonian model to calculate the properties of curve as the thread cannot be expected to curve space-time as thread is hypothesised to be the cause of space-time. Newtonian model would also simplify calculations.

3. For calculations, we assume that the thread is extremely long but not truly infinite, so that we can avoid issues of infinite force. Though we are taking Newtonian model to calculate the curve, we are applying some more conditions to it. Newton's law of gravitation assumes instantaneous action at a distance which will make the force acting in the section of the thread to be infinite or too big and make any further calculation impossible. Hence, we are taking additional conditions, that the information can only pass at the speed of light and not be instantaneous. This also makes the effective length of thread limited

to the length of thread that can relay the information.

4. The thread is flat at rest. The thread also start at rest (equilibrium position).

5. The thread has some mass. We wanted to consider a thread without mass but with some tension. But such a thread will not move when flat or a circle at rest, and hence we changed our assumption.

6. For ease, thread can be considered to be a bose-einstein condensate of undefined boson. This will give us few properties that are desirable for the thread such as having uniform mass-energy density, having wave like property, etc. We also assume that the thread is in motion only due to its own mass-energy.

7. Smallest units are planck units.

8. Thread is fixed at the ends. We are assuming that the thread is fixed at ends as the thread is actually close to infinite in length.

9. Other perfect conditions. This is also supported by the fact that there is uniform distribution of matter in the universe on a macro scale.

Thread being fixed at ends will lead to the curves generated as standing waves. In a system that starts its motion purely due to its mass and gravitational effects, the most likely scenario is that the thread would begin vibrating in its fundamental mode, corresponding to a harmonic number n=1. This is because the gravitational pull would be strongest at the center of the thread, pulling it downward and setting it into motion. The fundamental mode is the simplest and lowest-energy state, and it's often the default state for systems that are disturbed from equilibrium in a symmetric manner. In the case of a Bose-Einstein condensate (BEC), all the particles in the condensate are in the lowest energy state at extremely low temperatures. If the thread is modeled as a BEC, it would be reasonable to assume that it would also prefer to oscillate in its lowest energy state, further supporting the idea that it would vibrate in its fundamental mode (n=1).

$$L = n \cdot l_p$$
$$r = m \cdot l_p$$

The length L of the thread is defined as the portion of the thread over which information (or light) can travel during one complete oscillation T. Given that information travels at the speed of light c, the length L is given by $L = c \times T$.

6 Mathematical calculations

6.1 Context

The thread experience oscillatory motion due to its own weight. As the motion causes one of the anti-nodes to reach the peak, particles are created (on the other side)at the peak where the anti-node reaches the highest spatial value of the thread. This can be imagined as a ball at the top of the hill. The ball (or particle) which starts from the peak at zero velocity starts its motion with an acceleration that is depending on the curve of the thread. Assume that the curve was at its peak height and then it decreases as it continues its oscillation. The acceleration then decreases along with the reduction of height of curve as the steepness angle also decreases. This will then have an impact on the ball's velocity as it is rolling towards the edge of the thread.

Here, we would try to arrive at the velocity of the ball at an 'x' position of the thread depending on when it started. So, we hope to express this as an equation with variables x and t. Later, we will evaluate how fast the particles that are ahead (started rolling before the observer) moves in comparison to the observer. Then, we will match this value with the Hubble's value to test the hypothesis or to identify at what stage of the curve the universe is in.

6.2 Defining movement of our thread

The formula for vertical displacement y(x,t) will be decided by the nature of the curve that our thread generates. Our thread is fixed at both ends which will create a 'standing wave' rather than a traveling wave. Wave equation for a standing wave is given as below

$$y(x,t) = 2A \sin\left(\frac{n\pi x}{L}\right) \cos(\omega t) \tag{1}$$

Here:

- A is the amplitude of each of the two traveling waves that make up the standing wave. Determines the maximum vertical displacement.
- n is the harmonic number (1 for the fundamental frequency, 2 for the first overtone, etc.).Determines the number of antinodes and nodes.
- L is the length of the thread.
- ω is the angular frequency of the oscillation. Determines how fast the thread oscillates.

$$\omega = \frac{2\pi}{T}$$

In the case of our thread, which starts its motion purely due to its own mass distribution and has properties similar to a Bose-Einstein condensate (BEC), the harmonic number would likely be $n = 1$, corresponding to the fundamental frequency. This is because of the following reasons.

1. Self-Initiated Motion: Since the thread starts its motion due to its own mass distribution, it's reasonable to assume that the motion would be most significant at the center, where the gravitational pull is strongest. This would naturally lead to a fundamental mode of vibration.

2. Uniform Properties: A BEC has uniform mass-energy density and wave-like properties. This uniformity would favor a simple, fundamental mode of oscillation rather than complex, higher-order harmonics.

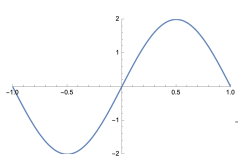
3. No External Forces: The absence of external forces or constraints means that the thread is free to move in the simplest way possible, which would be the fundamental mode.

4. Initial Conditions: Given that the thread starts from a flat, rest position and begins to move due to internal forces, the simplest and most symmetric mode of oscillation would be the fundamental frequency.

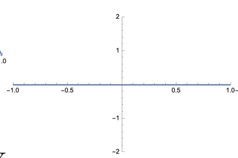
Given these considerations, it's reasonable to start with the fundamental frequency ($n = 1$) as the harmonic number for our thread.

Substituting the values for n, ω, and L in the function, we get:

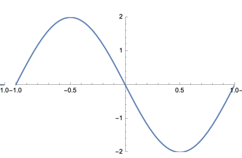
$$y(x,t) = 2A \sin\left(\frac{\pi x}{cT}\right) \cos\left(\frac{2\pi t}{T}\right) \tag{2}$$



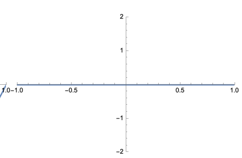
(a) wave at t=0 & t=1



(b) wave at t=0.25



(c) wave at t=0.5



(d) wave at t=0.75

Figure 2: Wave function

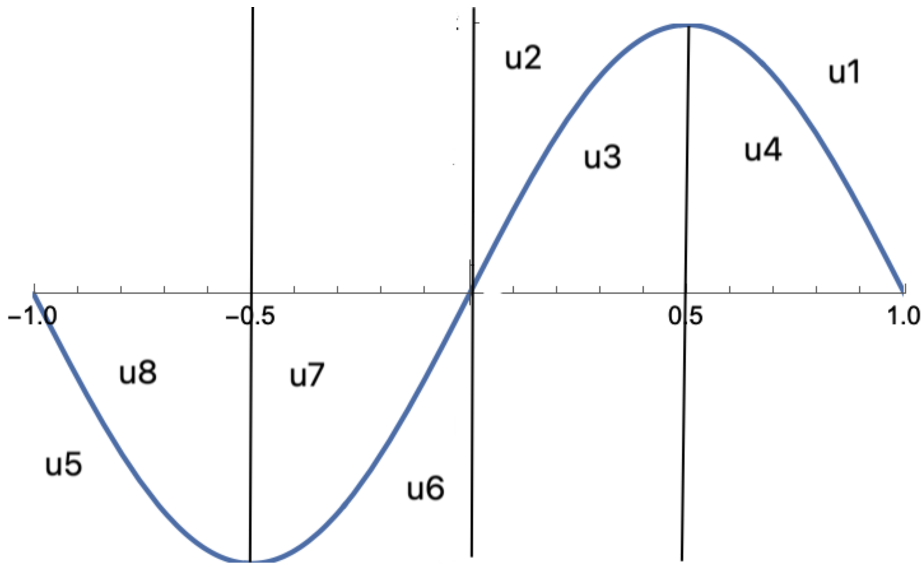


Figure 3: Octaverse in the wave function obtained where each of the 8 portions of the thread would have different impacts on the motion of particles leading to 8 different universes.

6.3 Arriving at the formula for acceleration

To arrive at the formula, first consider a ball rolling down the hill from the peak. The acceleration of the ball is given as

$$a = g\sin(\theta) \tag{3}$$

θ in our equation for acceleration 3 represents the angle between the tangent to the thread at a specific point x and the horizontal axis at a given time t.

We can visualize it by imagining a tiny segment of the threa around a point x. If we draw a tangent line to the thread at that point, θ (x,t) is the angle between this tangent line and the horizontal axis.

The angle θ is positive if the thread is curving upwards at that point and negative if it's curving downwards. When the thread is flat, $\theta = 0$.

Mathematically $\theta(x,t)$ is given by the inverse tangent (arctan) of the slope of the thread at that point, which is the derivative of the vertical displacement y(x,t) with respect to x:

$$\theta(x,t) = \tan^{-1}\left(\frac{\partial y}{\partial x}\right)$$

To find $\theta(x,t)$, the angle of the curve with respect to the horizontal, we need to take the derivative of $y(x,t)$ with respect to x. Taking the derivative $\frac{\partial y}{\partial x}$, we get:

$$\frac{\partial y}{\partial x} = 2A\left(\frac{\pi}{cT}\right)\cos\left(\frac{\pi x}{cT}\right)\cos\left(\frac{2\pi t}{T}\right)$$

Finally, $\theta(x,t)$ is given by:

$$\theta(x,t) = \tan^{-1}\left(2A\left(\frac{\pi}{cT}\right)\cos\left(\frac{\pi x}{cT}\right)\cos\left(\frac{2\pi t}{T}\right)\right) \tag{4}$$

Our equation for acceleration of the particles 3 contains the term g. This g may not strictly be the gravitational acceleration as traditionally understood; in any case, it serves as a simplified parameter to capture the influence of the thread's localized mass distribution on particle motion. As g is not a constant by itself as is obtained through formula, let's see what we can use in our calculation.

We have that

$$g = \frac{G \cdot M}{r^2} \tag{5}$$

Where G is the gravitational constant and M is total mass of the thread. Both of these are constant for our thread for any point of space and time. This means that the changing factor is r^2.

r is the distance between the effective center of mass of the thread and the particle in question.

For the wave of our equation with two traveling waves moving in opposite directions, we know that center of mass is same as the center of thread or the epicenter as we have defined. We can also attempt to arrive at the same conclusion mathematically.

The center of mass for a continuous object like the thread can be calculated using the integral:

$$\text{Center of Mass (COM)} = \frac{\int x\rho(x)dx}{\int \rho(x)dx}$$

Here, $\rho(x)$ is the mass density of the thread at position x. Since we're assuming the thread has uniform density, $\rho(x)$ is a constant, ρ.

However, because the thread is oscillating, its shape changes with time, and so does its center of mass. To find the effective center of mass as a function of x and t, we need to consider how the mass is distributed along the $y(x,t)$ curve at each instant t.

The mass element dm of a segment dx of the thread is $\rho A dx$, where A is the cross-sectional area of the thread. The y-coordinate of the center of mass $\bar{y}$ at time t can be calculated as:

$$\bar{y}(t) = \frac{\int y(x,t)\rho A dx}{\int \rho A dx}$$

Since ρ and A are constants, they can be pulled out of the integrals:

$$\bar{y}(t) = \frac{\rho A \int y(x,t)dx}{\rho A \int dx}$$

$$\bar{y}(t) = \frac{\int y(x,t)dx}{\int dx}$$

The wave function for the thread is $y(x,t) = 2A\sin\left(\frac{\pi x}{cT}\right)\cos\left(\frac{2\pi t}{T}\right)$.

To find $\bar{y}(t)$, we integrate $y(x,t)$ over the length of the thread, from $-L/2$ to $L/2$:

$$\bar{y}(t) = \frac{\int_{-L/2}^{L/2} 2A\sin\left(\frac{\pi x}{cT}\right)\cos\left(\frac{2\pi t}{T}\right)dx}{\int_{-L/2}^{L/2} dx}$$

Upon integrating, we find that the sin terms will integrate to zero over a complete period, leading to $\bar{y}(t) = 0$.

This result is consistent with the idea that the thread is oscillating symmetrically about its midpoint. The positive and negative contributions to $\bar{y}$ from the oscillations cancel out, leaving $\bar{y} = 0$.

This means that center of mass is on the center of the thread.

At this point we can make a call whether to replace g with some constant for simplifying calculation, or to express it as GM/r^2, with r as a variable.

If we are using r as a variable, we have to find r in terms of x. For this, we have to identify which universe we are considering for the equation.

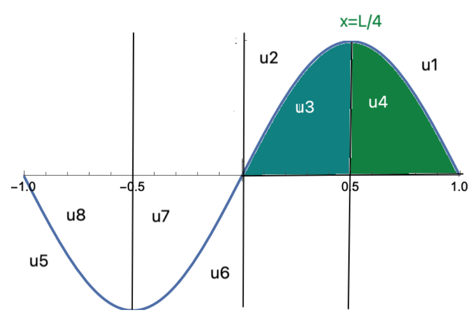


Figure 4: Selection of universe for calculation

Depending on whether we are considering our universe to be u3 or u4 (particles moving from peak towards the epicenter or away from it), the equations for r would change.

As our universe experiences movement of particles (clusters of galaxies) away from each other at increased velocities, we can assume u3 as our universe. We can then take that $r = (L/4) - x$ if the thread's curvature is small compared to its length.

But as we do not know whether the curvature is small or not for its length, we will have to find the actual relationship between r and x.

If the thread is oscillating and potentially has a significant curvature, then the distance r from the epicenter to a point on the thread would be along the curve of the thread, not a straight-line distance. In this case, r would be the arc length from the epicenter to the point x along the curve described by your wave equation.

The arc length s of a curve $y(x)$ from $x = a$ to $x = b$ is given by:

$$s = \int_a^b \sqrt{1 + \left(\frac{dy}{dx}\right)^2}\, dx$$

For our wave equation, $\frac{dy}{dx}$ is:

$$\frac{dy}{dx} = 2A\frac{\pi}{cT}\cos\left(\frac{\pi x}{cT}\right)\cos\left(\frac{2\pi t}{T}\right)$$

As we are talking about universe in a fundamental way, it is sensible to take planck units to discuss the values. If we use Planck units where $c = 1$, which makes $L = T$, we get:

$$\frac{dy}{dx} = 2A\frac{\pi}{L}\cos\left(\frac{\pi x}{L}\right)\cos\left(\frac{2\pi t}{L}\right)$$

The distance r from the center to the particle at x would then be:

$$\begin{aligned} r = &\int_{\frac{L}{4}}^{0} \sqrt{1 + \left(2A\frac{\pi}{L}\cos\left(\frac{\pi x'}{L}\right)\cos\left(\frac{2\pi t}{L}\right)\right)^2}\, dx' \\ &- \int_{\frac{L}{4}}^{x} \sqrt{1 + \left(2A\frac{\pi}{L}\cos\left(\frac{\pi x'}{L}\right)\cos\left(\frac{2\pi t}{L}\right)\right)^2}\, dx' \end{aligned} \tag{6}$$

This integral would give us $r(x,t)$, the distance along the curve from the epicenter to the point x at time t.

We can substitute this $r(x,t)$ in the equation to arrive at g 5.

$$\begin{aligned} g = GM \Bigg(&\int_{\frac{L}{4}}^{0} \sqrt{1 + \left(2A\frac{\pi}{L}\cos\left(\frac{\pi x'}{L}\right)\cos\left(\frac{2\pi t}{L}\right)\right)^2}\, dx' \\ &- \int_{\frac{L}{4}}^{x} \sqrt{1 + \left(2A\frac{\pi}{L}\cos\left(\frac{\pi x'}{L}\right)\cos\left(\frac{2\pi t}{L}\right)\right)^2}\, dx' \Bigg)^{-2} \end{aligned} \tag{7}$$

Substituting the value of g and θ in our earlier equation for a 3, we get:

$$
\begin{aligned}
a = GM & \left(\int_{\frac{L}{4}}^{0} \sqrt{1 + \left(2A\frac{\pi}{L} \cos\left(\frac{\pi x'}{L}\right) \cos\left(\frac{2\pi t}{L}\right)\right)^2} \, dx' \right. \\
& \left. - \int_{\frac{L}{4}}^{x} \sqrt{1 + \left(2A\frac{\pi}{L} \cos\left(\frac{\pi x'}{L}\right) \cos\left(\frac{2\pi t}{L}\right)\right)^2} \, dx' \right)^{-2} \\
& \times \sin\left(\tan^{-1}\left(2A\left(\frac{\pi}{L}\right) \cos\left(\frac{\pi x}{L}\right) \cos\left(\frac{2\pi t}{L}\right)\right)\right)
\end{aligned}
$$

This gets simplified to

$$
\begin{aligned}
a = GM & \left(\int_{\frac{L}{4}}^{0} \sqrt{1 + \left(2A\frac{\pi}{L} \cos\left(\frac{\pi x'}{L}\right) \cos\left(\frac{2\pi t}{L}\right)\right)^2} \, dx' \right. \\
& \left. - \int_{\frac{L}{4}}^{x} \sqrt{1 + \left(2A\frac{\pi}{L} \cos\left(\frac{\pi x'}{L}\right) \cos\left(\frac{2\pi t}{L}\right)\right)^2} \, dx' \right)^{-2} \\
& \times \frac{2A\left(\frac{\pi}{T}\right) \cos\left(\frac{\pi x}{T}\right) \cos\left(\frac{2\pi t}{T}\right)}{\sqrt{1 + \left(2A\left(\frac{\pi}{T}\right) \cos\left(\frac{\pi x}{T}\right) \cos\left(\frac{2\pi t}{T}\right)\right)^2}}
\end{aligned} \tag{8}
$$

For ease of expressing this equation repeatedly, we will define 'g(x,t)' to denote the portion of the equations that shows itself at multiple places.

That means we define

$$
g(x,t) = 2A\left(\frac{\pi}{T}\right) \cos\left(\frac{\pi x'}{T}\right) \cos\left(\frac{2\pi t}{T}\right) \tag{9}
$$

Replacing with $g(x,t)$ in the equation for $a(x,t)$,

$$
\begin{aligned}
a = GM \cdot & \left(\int_{\frac{L}{4}}^{0} \sqrt{1 + (g(x,t))^2} \, dx' \right. \\
& \left. - \int_{\frac{L}{4}}^{x} \sqrt{1 + (g(x,t))^2} \, dx' \right)^{-2} \\
& \times \frac{g(x,t)}{\sqrt{1 + (g(x,t))^2}}
\end{aligned} \tag{10}
$$

This gives us acceleration of a particle at location x and time t.

6.4 Arriving at the formula for velocity

Now imagine that a particle is getting formed at peak and then rolling down the thread towards the center. The thread also moves as per its wave function as time proceeds. We need a function to calculate what would be the velocity that the particle would have achieved at x position in the thread at time t of oscillation due to all the cumulative changes in acceleration.

We know that for straight motion,

$$v = u + a * dt$$

Also,

$$s = r + D * v * dt$$

Where s is the total distance traveled, r is the initial distance traveled, D is the direction of the motion, v is the velocity, and dt is the time.

In the case of our equation, this gets translated to

$$x_n = x_{n-1} + (-1) \times v_{n-1} \times dt$$

But here, we are assuming that the motion of the particle is along a straight line. But the motion is infact along the arclength of the curve as our thread is curved in space, and the particles are rolling along this curve. This means that motion is determined by the arclength s along the curve.

$$s = \sqrt{dx^2 + (v_{n-1} \times dt)^2}$$

This can be understood by imagining a triangle where s is the hypotenuse, dx is one side of the triangle and another side can be arrived at by multiplying v (previous velocity) with dt. Then we will get the hypotenuse s by squaring both of the other sides and adding them.

$$x_n = x_{n-1} + (-1) \times \sqrt{dx^2 + (v_{n-1} \times dt)^2} \tag{11}$$

This is a simplified model and assumes that the curvature of the thread is not changing significantly over the small time step dt.

We are not taking a similar approach for calculating v, as we are assuming that the the curve of the thread is already accounted for in the acceleration term and hence not required to be considered in the velocity term.

$$v_n = v_{n-1} + D \times a(x_{n-1}, t_{n-1}) \times dt$$

This gives us that the velocity $v(x, t)$ of such a particle can be expressed as:

$$v(x, t) = \int_{t'}^{t} a(x', t'')dt'' \tag{12}$$

Where t' is the time at which a particle is formed at $x = L/4$. Then, the particle will have been in motion for a duration $\Delta t = t - t'$ when it reaches x at time t.

Now, a particle at a point of space at a point of time will have a single value of velocity and it can be used to estimate when the particle originated. The time t' at which a particle was formed at $x = L/4$ can be determined by backtracking its motion from x to $L/4$. To find t', we need to solve the equations for distance 11 and velocity 12 iteratively, starting from x and going back to $L/4$, while keeping track of the time steps. The sum of these time steps will give us $\Delta t = t - t'$.

6.5 Empirical evidence

Our next step is to evaluate our hypothesis with empirical evidence.

While we can play with the numbers around age or radius of the (observable) universe, a better approach might be to use Hubble's constant. Hubble's Constant, denoted as "H0," is a fundamental cosmological parameter that describes the rate at which the universe is currently expanding. It quantifies the relationship between the distance to a distant galaxy and its recession velocity due to the expansion of the universe. In other words, it tells us how fast objects in the universe are moving away from us as a function of their distance.

$$v = H_0 \cdot d$$

Where: - v is the recession velocity of a distant galaxy (in km/s). - H_0 is Hubble's Constant (in km/s/Mpc). - d is the distance to the galaxy (in megaparsecs).

Observational values for Hubble's constant change from 69.8 km/s/Mpc to 74 km/s/Mpc. The constant is expected to be around 68 km/s/Mpc using the current understanding of physics.

We need to identify for what value does Hubble's constant gets satisfied in our model. We will have to also evaluate if our system predicts the change in Hubble's constant observed due to the variation in time and distance.

We can attempt to find out for what conditions and values do we obtain $\frac{v(x,t)}{x}$ as equal to Hubble's constant.

We can also explore if Hubble's relation is true for our model. To find when $\frac{v(x,t)}{x}$ is constant, i.e., when the derivative of $\frac{v(x,t)}{x}$ with respect to x is zero, we can solve the following equation.

$$\frac{d}{dx}\left(\frac{v(x,t)}{x}\right) = 0 \tag{13}$$

Then, the equation v divided by x for that particular value of t can be used to see if we are getting Hubble's constant and/or for what value of x we are getting the constant. Then, we can use the equation to explain the variation in Hubble's constant across time and space in the universe.

If the equation is not true, we can still use the ratio of velocity to distance for different values of x and t to see which one suits Hubble's constant. This can give more information about our position in the universe (distance from big bang in the 'past' space) and the age of the universe and/or solve the difference in observational values of Hubble's constant.

Here, we are not attempting to solve the equations as computational power to solve them is not available at this point to the author.

This will be the scope of physicists with access to computational power.

If the solution is too complex to be solved analytically even with better systems, we can take simplifications such as g being a constant or curvature of the thread being negligible compared to its length. If we are unable to arrive at analytical solution to this equation, we can always arrive at numerical solution by replacing dt with planck time. Wherever we require minimum values quanta of units, we can go for planck units as they appear to be fundamental.

7 Implications

If the theorem matches with the empirical value and is proved, it will have many implications on our understanding of the world. Some of them are discussed below.

7.1 Unidirectional time and space

Time and space, both are unidimensional even in our universe with respect to the direction of epi-center (or big bang).

This is the reason why we do not see an origin of big bang in our universe and we see that all of observable universe is expanding away from us as if we are the center of the universe. It is because the location of time of events such as big bang and particles formed after us are in the future of time, and also in future of space and has not had and will never have an impact on our location of universe, until the oscillation of thread reverses or move away from flat line . It is because the velocity of the particles rolling down the thread will always increase and would ensure that there is only one particle (or a group of particles) at one location at one time. There will definitely be some change in microscale due to the interactions between the particles formed when they are intially formed causing them to clump together and form clusters of galaxies. As they become closer, there will be more types of interactions between them such as weak force, strong force, electromagnetic force etc.

We can imagine our location in the universe as on the event horizon where we will never see the objects of the future (objects between us and the epi-center) and also the object of the past that crosses velocity beyond the speed of light. This can change as the thread changes the direction of its oscillation.

It also tells that on both the sides, there will be minimum of one space and time, but one of them will be uni-directional for one side of the curve.

7.2 Universes with 3 time dimensions

The universe under the thread (assuming we are at the 'top' of the thread) will have 3 dimensions of time and one unidirectional dimention of space.

We have the equation for Schwarzschild Metric in Schwarzschild Coordinates as given below, which describes simple blackholes.

$$ds^2 = -\left(1 - \frac{2GM}{r}\right) dt^2 + \left(1 - \frac{2GM}{r}\right)^{-1} dr^2 + r^2(d\theta^2 + \sin^2\theta d\phi^2)$$

Here, G is the gravitational constant, M is the mass of the black hole, t is time, and r, θ, and ϕ are spherical coordinates. The event horizon is at $r = 2GM$.

Notice that the coefficient of dt^2 becomes zero at the event horizon ($r = 2GM$), and it becomes negative for $r < 2GM$, inside the event horizon. Similarly, the coefficient of dr^2 becomes infinite at the event horizon and swaps sign inside it.

This leads to a notion that, inside the event horizon, r acts like a time coordinate and t acts like a space coordinate. This Schwarzschild solution is hinting at the existence of a 'time-space' universe beneath our 'space-time' universe, and the switch in roles of r and t is an artifact of this deeper structure. This is also taken as an assumption is this paper.

7.3 Different constants in different universes

The universe under the thread (assuming we are at the 'top' of the thread), i.e., time verse, will have different complementary constants.

For all the calculations, we need to find equivalents of c (speed of light), G (gravitational constant), h (Planck constant), and μ (energy density)in the time-verse.

We are making another important assumption that for the constants and units that do not have time or distance in its simplest form, there will be no change in the units or values in the timeverse. For example, q, which is charge of a particle, will not undergo change to a different unit in timeverse. This is also in line with the mathematical equations of Reissner-Nordström solution (that talks about behaviour of charged blackhole) arrived at by extending beyond singularity. Also, even though mass is a property of space, as both the verses have at least one dimension of space, the mass of is also taken as a unit that would stay same in both the verses. The reason we are citing that both the universes have at least one dimension of space is by once again extending Schwarzschild solution. Given that we have access to unidirectional flow of one axis of time (only forward), applying the same logic of Schwarzschild solution gives that the time-space world has unidirectional space.

Next, we will arrive at timeverse equivalents for c, G, h and μ. We will discuss how we can arrive at the actual values for the timeverse twins, and if possible, derive the actual values now. If we are unable to simulate the solutions, we may not use them for our calculations and adhere to the space-verse variables.

The value for c is arrived at through experiments as c is an empirical value. We cannot measure the equivalent of c in time-space, at least for now. Hence, we are using the assumption that time-space verse mirrors the space-time verse in the axis of space and time. We know that in the context of special relativity, c is a conversion factor between space and time. Hence, our new unit D, which stands for Doorata (distancivity in Sanskrit), should be a conversion factor between time and space. This gives the unit (SI) of D as s/m denoting how much time is covered in unit space in the time-space verse.

In the Schwarzschild metric for a black hole, we have:

$$ds^2 = -\left(1 - \frac{2GM}{r}\right) dt^2 + \left(1 - \frac{2GM}{r}\right)^{-1} dr^2 + r^2(d\theta^2 + \sin^2\theta d\phi^2)$$

The units of G in this equation are $\frac{m^3}{kgs^2}$.

In the time-space universe, we replaced G with P, t with r, and r with t. Here, P stands for patience, which is G equivalent in time-space.

If the Schwarzschild metric in the time-space universe is:

$$ds^2 = -\left(1 - \frac{2PM}{t}\right) dr^2 + \left(1 - \frac{2PM}{t}\right)^{-1} dt^2 + t^2(d\theta^2 + \sin^2\theta d\phi^2)$$

Then the units of P must be $\frac{\mathrm{s}^3}{\mathrm{kg\ m}^2}$ for the equation to be dimensionally consistent.

The energy density μ in space-time is defined as:

$$\mu = \frac{c^2}{Gr^2}$$

And let's say the energy density μ' in time-space is defined as:

$$\mu' = \frac{D^2}{Pt^2}$$

$$\text{Unit of } \mu = \frac{\mathrm{kg}}{\mathrm{m}^3}, \qquad \text{Unit of } \mu' = \frac{\mathrm{kg}}{\mathrm{s}^3}$$

Here we can notice that μ is in the units of kg per space (m3) while μ' gave kg per time (s3). This must mean that Energy acts in time-space verse per time (of 3 dimensions) and not on space. This might also imply that time-verse has three dimensions of time and one dimension of space.

To arrive at the values for constant and for our subsequent calculations, we are assuming the following: 1. The total mass-energy content of the bi-verse remains constant. 2. The universal constants for time-verse can be arrived at by equating it over planck dimensions and/or entire uni-verse dimension.

To arrive at some sort of relation between any of the spaceverse and timeverse particles, we need a constant that is deemed to stay same in both the verses.

As photons are massless and chargeless, and from its perspective, it stays at same time and space in the universe, it will be a fair assumption that photons do not change its properties in timeverse, and can be taken as a fundamental particle. Let's assume that the maximum energy held by a photon will be same in either of the universe.

We know the following.

$$E = \frac{hc}{\lambda}$$

For planck length, which is a distance we know, we get

$$E = \frac{hc}{\text{Planck Length}} = \frac{h \times \text{Planck Time}}{D}$$

$$\Rightarrow D = \frac{\text{Planck Length} \times \text{Planck Time}}{c}$$

As Planck Length $= 1.61626 \times 10^{-35}$ m and Planck Time $= 5.39 \times 10^{-44}$ s

$$\Rightarrow D \approx 2.90588 \times 10^{-87} \text{ m/s}$$

We have now found D. We can now use it to find P, short for patience (equivalent to Gravitational constant G for the timeverse).

The energy density μ in space-time is defined as:

$$\mu = \frac{c^2}{Gr^2}$$

And let's reiterate that the energy density μ' in time-space is defined as:

$$\mu' = \frac{D^2}{Pt^2}$$

Let's assume that the maximum possible energy to be achieved is same for both the verse. So, in the case of space-time, although the energy will be highest at the center, at center, the value is undefined and mathematics breaks down, so we take the distance of planck length away from the center. In order to get the energy from energy density we multiply μ with volume. Here, we take the minimum quanta of planck volume.

$$E = \mu \times \text{Planck Volume} = \frac{c^2}{G \times \text{Planck length}^2} \times \text{Planck Volume}$$

Similarly for the maximum Energy value in the timeverse, the calculation will come as follows.

$$E = \mu' \times \text{Planck timecubed} = \frac{D^2}{P \times \text{Planck time}^2} \times \text{Planck timecubed}$$

Equating both the equations we get that

$$\frac{c^2}{G} \times \text{Plancklength} = \frac{D^2}{P} \times \text{Plancktime}$$

This gives the value of P as

$$\Rightarrow P \approx 2.0912 \times 10^{-209} \, \text{s}^3\text{kg}^{-1}\text{m}^{-2}$$

7.4 The total mass-energy in our universe

The total mass-energy in our universe is a function of the energy generated from the oscillation of the thread from t=0 to t.

We will try to arrive at a relationship between T and E using two different formuli of Energy, one in which Energy equals energy density times volume and another in which Einstein's famous equation is used.

Method 1: Using $E = mc^2$

We start by expressing the energy E as mc^2. In our model, ρ is the energy density, which is essentially E per unit volume. Since the thread is one-dimensional, we can consider its "volume" to be equivalent to its length L. Therefore, $\rho = \frac{E}{L}$.

Rearranging to solve for ρ:

$$\rho = \frac{2E}{c^4T^2}$$

Substituting this into our final formula, we get:

$$\frac{c^2}{2cT} = G\frac{2E}{c^4T^2}\left(\frac{-1}{cT} + \frac{1}{l_p}\right)$$

Simplifying, we find:

$$E = \frac{T^2c^6l_p}{4G(Tc - l_p)}$$

Method 2: Using $E = \rho \times L$

In this method, we express E as $\rho \times L$, where $L = c \times T$ in our model. Essentially, $E = \rho \times c \times T$. This formulation is based on the idea that the energy E stored in the curvature would be the energy density ρ multiplied by the volume V or, in the case of our 1D model, the length L.

Substituting $\rho = \frac{2E}{c^4T^2}$, we get:

$$E = \frac{2E}{c^4T^2} \times c \times T$$

Simplifying, we find the same equation:

$$E = \frac{T^2c^6l_p}{4G(Tc - l_p)}$$

In both methods, we arrive at the same equation for E in terms of T, c, and G. This equation can be thought of as describing the energy stored in the curvature of the thread, as per our theoretical framework.

The peaking of the oscillation of the thread is expected to create the 'big-bang' in our universe and birth the particles through the vibrations or energy from the oscillation back to its rest position. The total energy that we arrived at is expected to convert to the creation of particles and/or expansion of the space-time that we witness.

The derived equation can be interpreted as describing the total energy associated with one full oscillation of the thread, given that it's expressed in terms of the time period T for one complete oscillation. A complete oscillation involves the thread moving from its rest position to a peak, then to the other extreme peak, and finally returning to its initial rest position.

In classical oscillators, the energy alternates between potential and kinetic forms. In the peak position, all the energy would be in the form of potential energy, which is stored in the curvature of the thread in our model.

This means that the equation likely represents the total energy of a complete oscillation cycle, but the value would also coincide with the potential energy at the peak of the oscillation, assuming that all the energy is converted into potential energy at that point.

This may be equated to the total mass-energy created at the instance of big bang.

7.5 Movement of the particles and entropy of the universe

Our theorem explains why objects farther from us move at a pace faster than the objects near to us. It is because the objects away from us had steeper curve than the objects nearer to us.

It also indicates that the world will stop the accelerating expansion of the universe and will become constant and even reverse it once the curve moves beyond the horizontal position to oscillate to the other side. This can be visualized as all the timeparticles in the supertimemassive stophole (super massive black hole equivalent in the time-space universe) comes out to our universe through the fabric (and thereby gets converted to space-time equivalent) and gets exhausted. Further, the particles are expected to then roll backwards to be together and create a similar big bang in the time-space world.

This may also lead to change in the property of entropy of the universe.

Also, The dx and dt between the particles in our mathematical equations may be able to explain the distance between the galaxy or galaxy clusters.

7.6 Properties and boundary conditions

The basic properties of the particles in our universe such as mass, electric charge, and spin, or properties of the universe such as entropy may be tried to be explained through the nature of the thread. For example, the thread has up & down and left & right (from a peak or a trough), all of which's combinations would cause varying properties for the particles in those regions. Another fundamental feature of the particles of the universe can be explained by the oscillation of the thread to one direction.

For example, the theorem can be used to explain antiparticles as particles that move to one side (left/right) of the curve while the normal particles as particles that move to the other side.

We also think that all the universal constants are due to the property of this thread and constants arrived till now can hence be used give boundary condition to define the properties of the thread. That is properties such as length of the threadtime of the thread, mass of the thread, amplitude of the thread etc. give rise to constants that we observe and these observed constants can be used to identify the properties of the thread.

7.7 Blackholes, whiteholes, and wormholes

This theorem can replaces the need for defining 'dark energy' as the reason for accelerated movement of particles, or explain dark energy as the property of motion of thread. This theorem might also disprove natural occurrence of wormholes.

The theorum shows that our universe is a whitehole, and it means that there could be blackholes inside white holes. Could this mean that large enough blackholes house whiteholes?

May be in the future, we may be able to leverage artificial creation of blackholes to learn more about it and convert one form of particles to another, or its time-space equivalent.

8 Future research

The mathematical equations requires solutions through the use of advanced computing.

Once the theorem is established, there is a lot of answers that can be covered by substituting values in the equations and taking universal constants as limits in the equations.

This theorem may also be compared to see if it explains the presence of dark energy in the universe or can be used to calculate the value of it at a given time and space.

9 Conclusion

This paper proposes several groundbreaking ideas.

1. Our world is created due to the oscillations of a thread, thus redefining it as a bi-verse or octa-verse with a space-time verse on one side and a time-space verse on the other.

2. We offer a new set of equations that could potentially answer unresolved questions in current cosmological models.

These findings not only provide new insights but also open avenues for future research.

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