



AN OVERVIEW OF SIMULATION AND ITS RELATION TO SPACE-TIME

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Abstract:Over the vast majority of human history, significant occurrences and phenomena have been conceptualised primarily in terms of space and time, either as absolute or relative dimensions. This has been the case regardless of whether the conceptualizations were absolute or relative. The goal of space–time analysis is to comprehend not only when and where events take place, but also why they do so. There have been various explanations and assumptions written regarding space and time ever since Albert Einstein presented this concept in 1915 in his "General Theory of Relativity," which was a great achievement in its own right. We have been able to both forecast and express the continuous spatial phenomena of the universe with the assistance of the true archives of space-time. Because of the peculiar nature of space and time, young researchers and physicists are compelled to investigate the previously established hypotheses and theories, immerse themselves in the sea of enigma that is space and time, and formulate their own forecasts.

I. INTRODUCTION

When anything happens is determined by time, while where something happens is determined by space. Both the research that has been done and common sense indicate that When and Where are linked and comparable concepts. This may be a straightforward argument to use when attempting to persuade a non-scientist of the existence of the space-time structure of the universe. The idea of "Simulation" may be articulated somewhat well via the lens of the Space-Time Continuum. Michio Kaku, a

Together with the idea of space-time, the speculation that we are living in a simulation is a more recent one. Nick Bostrom's trilemma, "the Simulation argument," which was published in 2003, was the impetus for the beginning of a number of other research publications that were weirdly fulfilling and rich in real-life data. There are two different scenarios that may play out: either we are the only intelligent life in the universe, or we are not. Each are scary in their own unique way. - Written by Andrew C. Clarke. The Loaf Space-Time model and short insights on various ideas regarding the structure of the mysterious space-time will be offered throughout the text together with insightful examples and actual research findings, all of which will be coupled with the Simulation Hypothesis at some point.

Worldlines, General Relativity, Lorentz Transformation, Planck's Era, Inflation, Singularity, Matrix, Simulation, and Continuum are some of the keywords that have been associated with this topic. theoretical physicist who works in the field of string theory, proposed that the expansion of the universe could be understood through the dimensional analysis of information, which he referred to as quantum energy, and how it creates space in relation to time. Kaku made this assertion in a paper published in the journal Physical Review Letters. Albert Einstein's idea of a fourth dimension, which he dubbed space-time and which functions as a tool for interpreting the physical processes of this astonishing universe, served as the foundation for his thought. In 1925, Werner Heisenberg



proposed a hypothetical claim that without space and time, it is difficult to formulate a physical theory. This led to the foundational assertion of string theory, which is considered to be one of the most acceptable theories by scientific communities to qualify for the unifying fundamental nature of forces, for the purpose of formulating "The Grand Unified Theory." In the 1960s, Stephen Hawking was the first person to suggest that string theory could be the basis of "The Grand Unified Theory." A mathematical model known as space-time is one in which space, which has three dimensions, and time, which has one dimension, are combined to produce a single continuum with four dimensions.

It wasn't until the beginning of the 20th century that scientists realised the cosmos isn't made up of a spatial arrangement of three length coordinate systems as they believed it was. Yet, Einstein introduced the idea of a space-time continuum in order to bolster the validity of his theory of relativity. The conclusion that may be drawn regarding the phenomena of the constant speed of light can be explained by using this notion. Space-time diagrams are also highly helpful for explaining the trajectories of material things, particularly when making quantitative judgements about the correct time perceived by an observer. This is because space-time diagrams show the progression of time from one point to another.

In the following article, an attempt is made to demonstrate that the universe is a simulated existence that is nested inside the expansiveness of the space-time continuum. With the use of a variety of mathematical and descriptive models, it attempts to verify the point.

II. THEORY AND CALCULATION

2.1. Time Dilation

Every Physics enthusiast must be accountable with the famous "The Twin Paradox". This

paradox encompasses the concept of Time Dilation. The bewildered young Physicists' query about the reason for Time Dilation is the reason for this paper's initiation. Let's come to the point. Time Dilation is the difference between the time measured by two different clocks, either due to having their different relative velocities with respect to one another, or being in different gravitational fields or due to difference in trajectory of the motion of accelerated particles in the space-time continuum.

Value of specific trajectory of the particle in certain acceleration:

$$\frac{1}{c}v(t) = \frac{2}{\sqrt{8}}(1 - \lambda ct) ; 0 < t < 2/\lambda c.$$

Integrating the above equation, we obtain,

$$T' = \frac{(2 + \pi) \frac{2}{\lambda c}}{4\sqrt{2}} \approx 0.908914 \frac{2}{\lambda c}$$

This shows that the time experienced by the accelerated object (T') is less than the time experienced by the inertial observer. The accelerated object experiences that the time is moving very slowly compared to the inertial observer (observer at 0 acceleration). The faster it moves through space the slower it moves through time. This is what time dilation refers to.

Also, from Lorentz Transformation Scale:

$$t' = \frac{t}{\sqrt{1 - \frac{v^2}{c^2}}}$$

2.2. Loaf-Stack Model

Now, let's try to grasp this in another way. Einstein once considered space-time as a loaf of bread (Time Compression Theory). He said Space-time is like a loaf of bread where each slice is a different slice and each slice acts as a different freeze frame during the continuous notion of the ever-expanding Universe (at the speed of 72 kilometers per second per megaparsec). The whole loaf exists now, but we are observing our way through just one slice at a time, so it seems to us like the slices ahead of us



do not exist yet, but they do exist in the loaf. We are currently in one of those very slices and are experiencing a Stubborn Illusion, so called Time (as mentioned by Einstein).

Now imagine yourself in the slice and also imagine an extraterrestrial creature, far about millions of light years in that slice. Consider that a creature moving towards the Earth has a difference in angle of 00 . Now consider the creature's orientation is such that his Time Worldline does not orient with the time world line if yours. The line might be disoriented with even a very small angle. But this small angle difference will result in a large difference between the length of the worldlines between that of mine and the creature. So that creature's world line might be oriented towards my future or my past. And my world line might be oriented toward his past or future and vice versa. This difference in worldlines causes a difference in passage and flow of time for that creature and for me. This causes time dilation for me and that creature. So that creature can travel through my past or future if he follows that direction or orientation of his original worldline and similar case for me as well.

2.3. Simulation

Are we real or are we programmed to be real? Such questions question our existence and fate. Over the advancement of technologies, people began to think and question their existence. How is the Universe so strange? Why is everything happening for a purpose? Why do we Homo sapiens sapiens (so considered as the smartest living being to live on the Earth so far) are still hitting around the bushes while explaining about the realities of the Universe? Religion and myth say that Everything about our life is written by "The God". What if "The God" is a programmer who is simulating our entire existence and who controls our fate and fate of the Universe?

Computer Simulation is a reproduction of a behavior using computer software to create a dynamic environment under desired mathematical and physical programmable laws. A version of the simulation hypothesis was first theorized as a part of a philosophical argument on the part of René Descartes, and later by Hans Moravec. The philosopher Nick Bostrom developed an expanded argument examining the probability of our reality being a simulation. Much evidence like "The Mandela Effect", "Sinbad Genie Movies", "The DNA-data theories" suggests some convincing evidence in the favor of we being Simulated by someone whose existence is beyond our comprehension and imagination.

Now, let's get into the real business. Now again imagine

space-time as the loaf of bread as I have mentioned above.

Let me add a few points on this version of Imagination and visualization.

Our past, present and future is already programmed in the slice of the space-time (n times the slice= the entire space-time (or think it as a loaf as a bread)). The present, past and the future may just be an illusion. In the day to day life we experience time as a continuous flow. But it can be pursued as the series of snapshots of each small moment of about Plank's unit (basic and fundamental entity for me. Nothing can get much smaller than this.) The time we are experiencing can be understood as the collection of the snapshots. And everything that happens can be visualized as the unfolding or flipping of these series of snapshots. And if we picturize and try to align each moment or snapshot lined up to form the very nature of the flow of time and existence of events with it, every moment of the Earth, Every moment of the Universe (ever since its birth to the formation of stars to the



creation of the Earth, to the events occurring now (like an explosion of the star, or a meteor striking any planet, the Earth revolving around the Sun or whatever that is happening at the same time at the different corners and regions of the Universe) to death of the Universe (meaninglessness of time) into a single comprehensible structure by stacking or piling them laterally, then we can imagine closed loop as a shape as of the Loaf of bread or a 3D parabolic curve which is nothing but a SPACE-TIME. These events are programmed or set into the slice or the snapshots of the space-time. Time seems to go forward because these snapshots of the minute events are oriented forward. So, what is going to happen in the next 5 minutes is already set into that snapshot in that slice or in that snapshot. (in whatever way you comprehend).

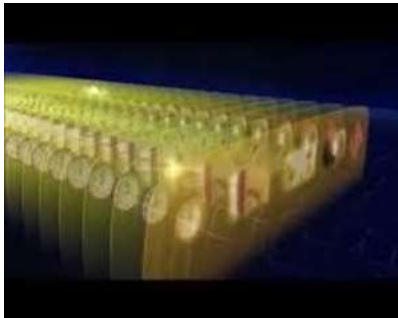


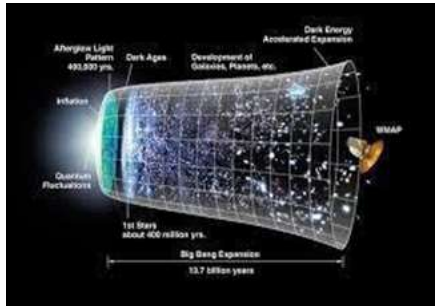
Fig: Loaf-Stack Model of Space-Time

Similarly, our future might already be set in those upcoming slices and snapshots, but for us those upcoming slices or those moments in the space-time continuum is impossible to reach (for now*). Same kind of concept holds true for the past as well. Each event is already set or programmed in that particular slice. Now let's imagine the Loaf of bread as a flip book and the slices as the paper (snapshots) of the flip book. So, while flipping through the snapshots of the flip book, we feel as if the characters drawn in the pages of the flip book are moving in real time. The same case holds for the flow of time. Imagine the space-time of Loaf structure as a

flip book where each page (with snapshots) are the parts or a simple phase or moment of that space-time. From the Origin of the Universe (Big-Bang (if this event actually happened)) to the end or death of the Universe (The point where Time becomes meaningless), every single bit of event is already set in these pages (as the snapshots) and the flow of time is just the moment of the flip book. Our future already exists. It is already programmed as bits of information.

This might seem absurd for many. But this is what I think is going on. That slice of the loaf or the page of the flipbook of the Space-time can be thought as a small bit of information storage system and our existence, activities and fate is the data being stored in that information storage system (i.e. the slice or the snapshot in the paper of the flip book, with whatever you may feel comfortable to grasp).

Every bit of basic unit of information [I would like to call it as a Planck Unit] is stored in the slice and the snapshot flows as if it is being animated or programmed to move forward in a particular direction and orientation. Within these slices the Laws of Classical Mechanics, including Newtonian Mechanics, upholds true and valid. Under the course of the events and flow of the snapshots, new law underlies. The flow of time, its existence and remorselessness, the events beyond this slice (slice where we Homo sapiens inhabit), other unexplored slices show different laws and phenomena. But one thing is sure: the entire functioning of our SPACE-TIME (concept explained above), the entire flow, the modulation and its loop and its discontinuation and so on is governed by a single unified law or I say it as a Principal Protocol or Master Algorithm. The maximum physical laws among the different slices might be different, but for some events among the slices, the laws might be related and also similar.



III. RESULTS, EVIDENCE AND DISCUSSION

The evidence that proves the Simulation argument is mentioned below. The following real life instances are the evidence and also the results that satisfy the aforementioned mathematical and descriptive theory.

3.1. Deja Vu

It is the most common example of this idea. We all have experienced, at least once in our life till date. When you see something or experience something deep inside your subconscious mind you begin to realize out of nowhere that you have already experienced this very moment sometime before at some particular time but in reality, you haven't experienced this moment anywhere before. This is Deja Vu. To explain this, I would like you to close your eyes and imagine the two models that I have mentioned above about the structure of the Space-Time, the slices or snapshots model and the flip book model. Now combining these two models can think of SPACE-TIME as the slices aligned in a manner as that in flip books where it can undergo continuous illusionistic motion like that we observe while flipping a flip book containing a series of snapshots. Our existence can be pursued as the flow which we perceive during the course of flipping of the data or fate programmed on the snapshots or slices which are stacked as bundles and combined to form so called SPACE-TIME. We are already programmed to do something. Our origin and fate are already decided and so for the Universe.

3.2. Bugs and Restrictions

Now consider all these hypotheses and reflect upon them. Above views and ideas clearly try to show that we are in a Simulation. We are under Simulation governed by some supreme beings whom we cannot understand and comprehend because that's what we are programmed to be. We are set within certain limits. No one can raise a question upon this fact. Why is it so? It is because of the Simulation. One day the video games will be difficult to distinguish from reality. The same is happening with reality. Someone has programmed and designed our existence, fate and the entire information are stored in the slices or the snapshots of the SPACE-TIME. In fact, the SPACE-TIME serves as a hard drive of the data and information of the Fate of all the events which are undergoing in every part of the Universe, every unreachable and unimaginable and impossible points of the Universe where human endeavors cannot reach. This access to such areas of the Universe is limited by our potentials and this potential is already programmed. The codes written by some unknown being governs our potential, our entire activities and our fate. We and our Universe are bound by the set of rules and are governed accordingly. The data structuring, the coding, analysis, errors, bugs can be seen in the Universe now and then and it can be viewed in a convincing way in SPACE-TIME -slices platform. The bugs can be some events that break the laws of physics like Tachyons (the particle which was believed to be faster than light). Since light's speed's dominance is unbeatable at least in our observable Universe, we can say due to some bugs arising in the codes, Tachyon were rumored to be faster than light. And more interestingly Tachyons are hypothetical. They don't exist. How amazing!!! Some bugs over the Slices of space-time during the late 60s Tachyons' concept emerged as the

particle that breaks the laws of nature. There are many such ideas in simulation theory which seem absurd but interesting, silly but logical.

Another bug might be the Paranormal Activities. The scenarios that we experience sometimes like the unexplained sounds, sightings etc. can be the glitches of the Simulation world where we are living.

Some rare Savants see a pattern in the surroundings. When they were asked to draw the pattern, they observed in the surrounding, the patterns showed closed resemblances with the Simulation matrix patterns. The savants might be those special glitches which could observe the Matrix patterns of the Simulated Universe.



Mathematical pattern drawn by Savants.

3.3. Velocity of Light

Everybody knows nothing in the Universe is faster than light. Since for such a Simulation of the World to be carried out, a smooth, fast and powerful microprocessor sort of thing must exist. So, Light's velocity might be the speed of that microprocessor.

3.4. Mathematics

The Universe possess a single, irrevocable language i.e. Mathematics. The Laws of Mathematics do not hold untrue in any point of the Universe. The Universe is so Mathematical. This discloses the fact that Mathematics might be the platform in which our Universe is created. In simple words, Mathematics might be the programming language of the Universe. Everything in the Universe can be explained in a Mathematical language. Strings, Atoms, DNA and every other basic entity and advanced phenomena can be explained Mathematically

without affecting its laws. In fact, It was recently found that DNA is programmable. (It is a solid proof of the World being in a Matrix)

3.5. Superstring Equations

Jim Gates Jr says that he observed computer codes in the basic strings of Nature. The String resembles bits of Computer codes of ones and zeros. He even says it is a special kind of computer code discovered by Claude Shannon (the father of information theory). These codes were found deep in the Equations that explain String theory. Therefore, this also provides strong evidence on the Universe being a Matrix.

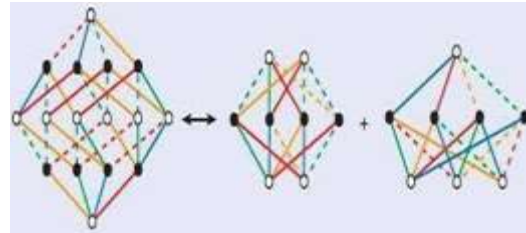


Fig: Computer Codes in Superstring Equation

IV. CONCLUSION

The paper under review breathes new life into the idea of a simulated universe by introducing a fresh dimension of understanding and assessment into it. It would seem that the Simulation hypothesis has strong support from a variety of other hypotheses. There has been a significant amount of research conducted, yet the general public and those that appreciate it haven't showed much connection to the subject's meat and potatoes. Young researchers obviously have an increased level of interest when they are given insight into a variety of pieces of data. The efforts made in this review article to explain the purpose of the Simulation theory as a legitimate argument have been commended by a number of readers who are noteworthy in their fields.

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Besides Physics, Reyan has been awarded the Young Innovator Award in his country over his engineering endeavors. He has also bagged several awards for his projects. Reyan is also founder and one of the Board of Directors in a student-led organization called Nepal Computer Science Alliance (NECSA). The organization aims to bring every Tech Talents under the same roof and work in various projects to meet a common goal. Overall, Reyan loves Physics and is always involved in making a difference through his endeavors.

AUTHOR'S PROFILE



Reyan Kumar Sapkota, was a student at St. Xavier's College, Maitighar, Nepal. Reyan has extensively involved himself in research in topics including Physics and Communications. He is involved in various independent and guided research projects.