Analogy Explanations

A fuller definition of the basic Time Compression Theory principles

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This document provides informal explanations to the time bubble, time cone, loaf of bread and compression of time in slightly more detail than in the Time Compression Theory: Underlying Principles study. It also introduces the affect time compression has on a pendulum.

Time Bubble

The time bubble is a concept that describes the exact position of an event relative to an observer, allowing us to define the time distance from an observer to an event. Every observer in the universe is at the centre of their own unique time bubble. The centre of the bubble is the observer's present. This bubble effectively replaces three-dimensional space with three-dimensional time. Every point on an observer's bubble is a specific time distance in the observer's past. On one bubble, every event is situated at the same time distance. But, in principle, each observer has infinitely many time bubbles situated around them at every time radius. Events near to the observer are in their close past and events farther from the observer are more distant in their past. Every point on the time bubble can be defined with time coordinates x, y and z. For example, we define the observer at the centre of the bubble with coordinates (0,0,0) measured in years, and define a supernova birth at $(x, y, z) = (2, 3, 4)$ on the observer's time bubble. This implies this time bubble has radius of $\sqrt{x^2 + y^2 + z^2} \approx 5.4$ years. We can say the supernova is therefore 5.4 years in the observer's past. This is an equivalent distance in time to a supernova birth situated at $(x, y, z) = (4, 3, 2)$, for example. A single time bubble and coordinate system is shown in Figure 1.

FIGURE 1: Time bubble visualisation

Imagine an observer as they are hit with a bullet fired from a gun. As the bullet gets closer to the observer, it gets closer to the observer's present and therefore, the radius of the time bubble that defines the bullet's position decreases. If the bullet travels through the observer, for a small amount of time, it is situated within the observer. In this case, the bullet's time bubble centre and the observer's time bubble centre unite. The bullet's present and the observer's present meet and therefore, one is no longer in the other's past. In theory, this only happens because we use an observer for simplicity, but in reality all particle's have their own unique time bubble's and every other particle, is in its past. Including the observer's particles and bullet's particles.

Time Cone

The time cone is a very similar visualisation to the time bubble, except points on the bubble are projected to points within the cone. An observer's present is at the tip of their time cone as opposed to the centre of their bubble. Visualising time as a cone, as shown in Figure 2, the observer, is at the tip of the cone, and every event in the universe is situated within the time cone in the observer's past. Nearby events are positioned closer to the time cone tip and more distant events are positioned further from the tip.

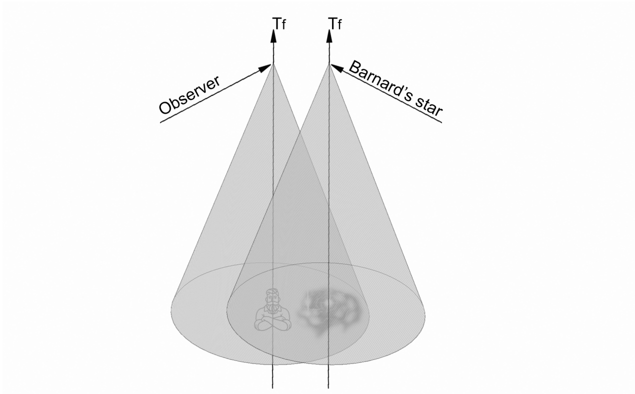


FIGURE 2: Time cone visualisation

Imagine a stationary observer, witnessing a stationary event. Their relative motion is zero and therefore that event does not move within the observer's time cone. But even when the observer is stationary, they still travel through time. We say, the time every observer travels through is called their timeline. Therefore, every observer's time cone progresses along their timeline in the forward direction, even when stationary. In undistorted time, the cone travels at a rate of time freefall, T_f, defined as the universal rate at which all matter aims to move through time. For example, Barnard's star is located approximately six light years from Earth [1]. We observe Barnard's star six years in our past, as the light takes a full six years to travel from the star to Earth. The star also observes us six years in its past, as the light from Earth takes six years to reach the star. Both the Earth and star are travelling along their respective timelines at T_f. Positions within the time cone define the distance in time between an event and an observer. Velocities and accelerations through

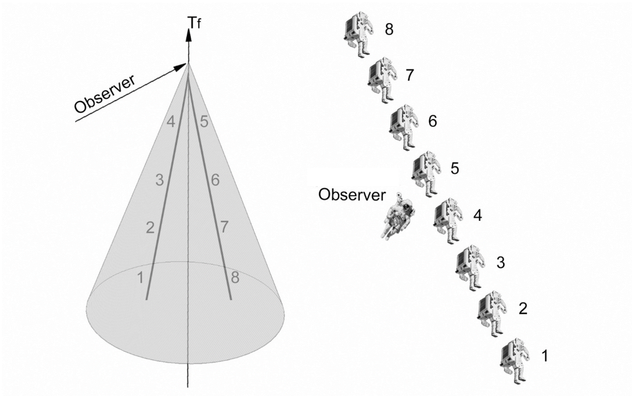


FIGURE 3: Relative motion on time cone

time are established as the relative motion between an observer and past events positioned within their time cone.

Imagine two observers, observer A and observer B, in undistorted time. If both observers have zero kinetic energy, they look weightless to each other as they both move through time at T_f. They are both located at the tip of their own time cones. Observer A is situated within observer B's time cone at time distance, t_1, from observer B's time cone tip. Observer B within observer A's time cone is situated the same time distance t_1, from observer A's time cone tip. Both observer's agree on their separation distance from the cone's tip to the other observer. If now, observer A has zero kinetic energy and observer B has a thruster providing a positive kinetic energy towards observer A – then observer A is witnessing observer B's past at a distance in time of t_1 seconds from the present, which is decreasing as observer B advances closer to observer A's time cone tip. Before reaching the tip, the observation retreats further into the past again as observer B passes observer A and begins moving away, as shown in Figure 3.

Imagine now, instead of observer B moving towards and away from observer A, observer A moves towards and away from observer B, and observer B is now stationary. The time cone will be unaffected, and still exactly the same as Figure 3, assuming the velocity of observer A is equivalent to observer B's previous velocity. Therefore, it does not matter which observer is moving, the relative motion defines trajectories within the time cones. This is mentioned in order to understand the principle of the time cone, but it does exclude the concept of time dilation, and in fact, when the astronaut is in motion, his time slows down. Time dilation is not discussed in the initial studies of the time compression theory, but has been considered, and will be discussed in future work.

We can again relate the time cone to a bullet being fired through an observer. As the bullet gets closer to the observer, it gets closer to the observer's present and the distance from the time cone tip (the observer's present) to the bullet (a witnessed event) decreases. For the small amount of time the bullet is in the observer, the bullet's time cone tip and observer's time cone tip are co-located. In other words, the bullet's present and the observer's present are the same. Similarly to the time bubble, this happens as we use an observer for simplicity, but in reality all particle's have their own unique time cone and every other particle is in its past. This means all particle's time cones within the bullet never coalesce with the particle's time cones within the observer.

Einstein's Loaf of Bread

Brian Greene's analogy of a loaf of bread describing spacetime is a visualisation that explains the difference in clock rate for a stationary observer compared to an observer in motion [2]. He showed how slices of 'now' can angle toward the past or to the future depending on the motion of an event or observer. The current logic demands that this loaf begins with a 'now' slice defining events occurring in the present moment in time, which involves displaying multiple events on a single plane, as shown in Figure 4.

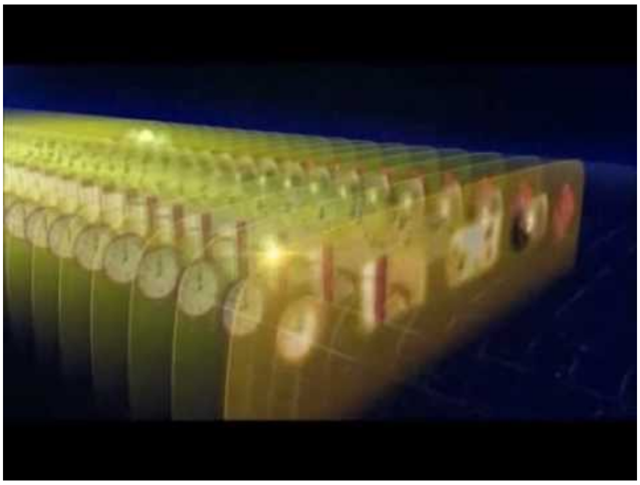


FIGURE 4: The Time Compression Theory's representation of Einstein's loaf for a supernova [3]

The underlying principles of the Time Compression Theory state that everything has its own 'now' slice, therefore, no two events can be located on the same slice. No event can be in another event's present and therefore every event has their own now slice. Any witnessed event by an observer is situated on a slice of the loaf in the past. For example, a five-year old supernova, whose birth can be witnessed at present by an observer on Earth, is on a slice of Einstein's loaf five years in the past from the 'now' slice. The supernova is on the same time plane as the Earth observer was situated five years ago, as shown in Figure 5. Vice versa, this works the same way from the supernova's perspective. The Earth, as observed by the supernova, is situated on a slice 5 years in the past from the supernova's 'now' slice.

Following this, at the birth of the supernova, we knew that the Earth would witness the supernova's birth five

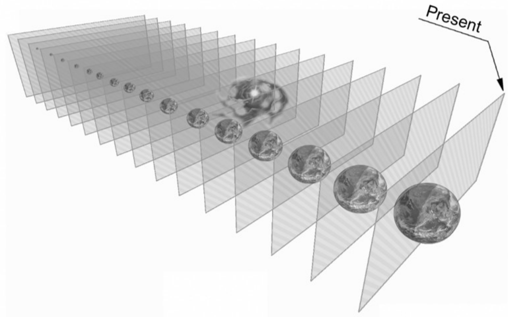


FIGURE 5: The Time Compression Theory's representation of Einstein's loaf for a supernova

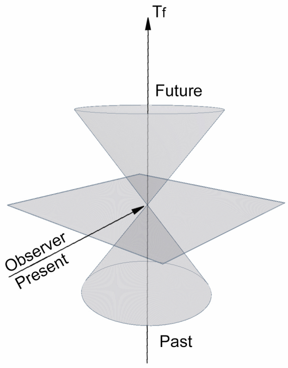


FIGURE 6: Two-dimensional spacetime curvature

years later. There are also many other observer's in the universe that witness the supernova's birth at different times. Therefore, there is a predetermined future of events in time that will witness the Supernova's birth. All of these future observations could also be mapped onto a cone. A cone of future events that are destined to be witnessed. This leads to the belief that the past, present and future, not only exist, but are predetermined. This applies to all events, for example, the moment we are born, the moment we die comes into existence. The moment a ball is dropped, the moment it hits the ground comes into existence. Even if an observer catches the ball stopping it hitting the ground - predetermined events within the universe meant that the observer was always going to catch the ball. What has happened, was always going to happen and what will happen, was always going to happen. Every observers' time cone is progressing along their timeline, witnessing past events in the present, with a cone of future events awaiting to be witnessed, as shown in Figure 4.

Although this takes a slightly different view to the current understanding of Einstein's loaf of bread, one thing is in agreement. That is, just as all of space exists, all of time exists as well. There is just as much reality to the future and the past as there is to the present moment. Following the bullet example from the time bubble and time cone, imagine a bullet having been fired through an observer. As the bullet gets closer to the observer, it gets closer to the observer's 'now' slice. For the small amount of time that the bullet is inside the observer, the bullet's 'now' slice and observer's 'now' slice are co-located. The bullet's present and the observer's present meet, and they are no longer in each others past. This is due to the fact that we use an observer for simplicity, but in reality all particle's have their own unique time slices with their own 'now' slices, and every other particle is in its past. The bullet's particle's 'now' time planes never coalesces with the observer's particle's 'now' time planes.

Compression of Time

General relativity is a theoretical framework where the presence of objects cause distortion in spacetime, creating a force of attraction, known as gravity. Figure 7 plots space against time for a constant velocity, acceleration, and deceleration, arising in the curvature of spacetime. This curvature is generally presented in two dimensions, reducing three-dimensional space into a single parameter.

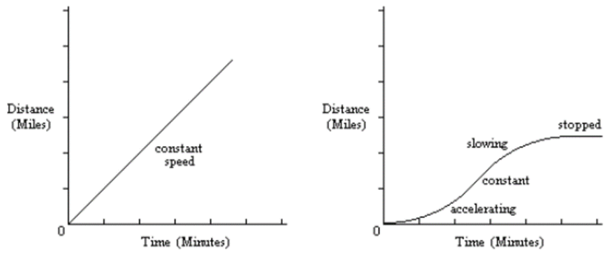
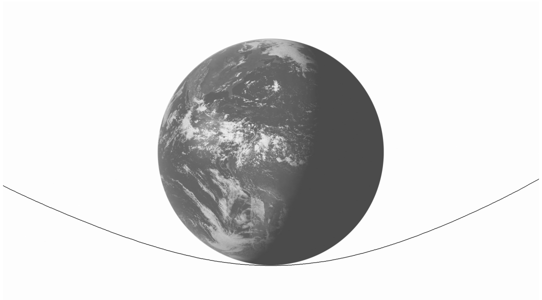


FIGURE 7: Past and future time cones

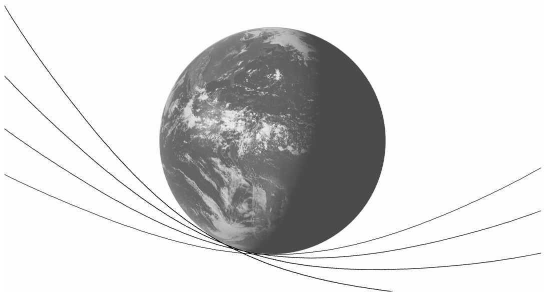
Figure 7, presents a loss of information due to the reduction in dimensions, resulting in a single spacetime curve as shown in Figure 8(a). This is therefore a misrepresentation of the full 360° deformation around a mass. When a single deformation curvature line is duplicated 360° around Earth, as shown in Figures 8(b), 8(c) and 8(d), a compression geometry forms.

The distance between the intersections of the spacetime curves decrease as one gets closer to the Earth, as shown in Figure 8(e). As one gets closer to a mass, the spacetime curves get increasingly more dense. From a geometrical point of view, as opposed to the curvature of spacetime - we see something is compressing. In the absense of space in the Time Compression Theory, we deduce that the presence of a mass distorts time, resulting in a structure of time compression.

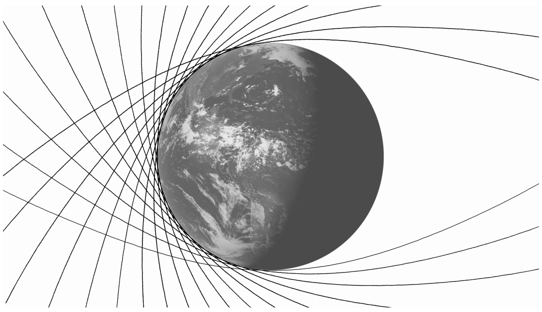
Since time appears to be something that can be compressed, we acknowledge that time itself must have an energy. We could go further than this and state that, the possible notion of compressing time, leads to a belief that time is a waveform. Time can travel through a vacuum and at the speed of light, it is therefore logical to think of time as an electromagnetic wave. Unlike gravity, time has the ability to interact with the other three fundamental forces. This does not present physics that is completely different to current understandings because the increase in time compression as one gets closer to the Earth is effectively proportional to the gravitational attraction towards the centre of Earth. The alteration can be described as - instead of an acceleration in space caused by gravity, there is an acceleration through time caused by time compression. From now on, within the Time Compression Theory, the concept of time compression will replace the gravitational force. In undistorted time, there exists energy, the energy of time. T_c, the time constant, is defined as the true energy value of the waveform of uncompressed time. As the compression of time increases, the energy increases, which can be visualised as energy rings circulating a mass, as shown in Figure 8(f). Although we can visualise distinct bands of energy around a mass, in practice these bands are infinitesimally small, increasing in energy as the distance to the mass decreases. The energy of a single band is $E_b = T_C + C_T$, which is the energy value of uncompressed time plus the additional energy due to time compression. Dependent on an object's energy compared to E_b, defines whether the object advances, retreats, or is situated on an energy band.



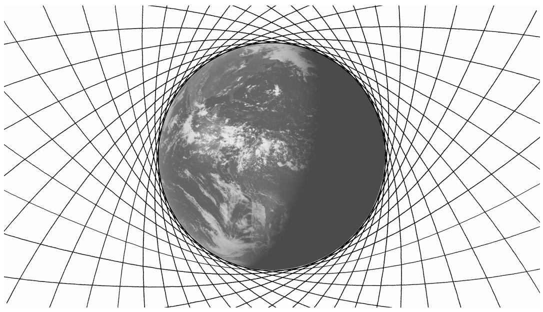
(a) A single spacetime curve



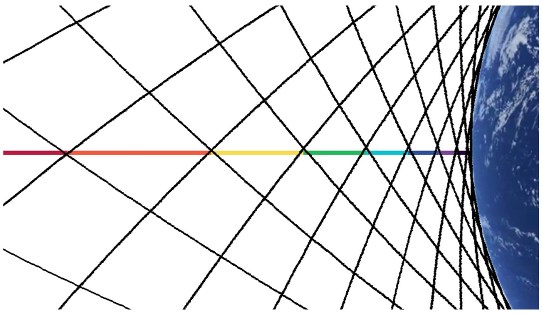
(b) Multiple spacetime curves



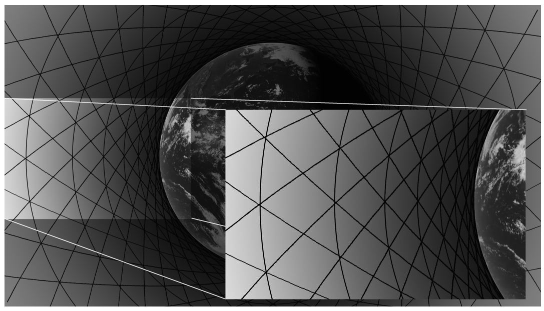
(c) Multiple spacetime curves



(d) 360^o curvature representation



(e) Decreasing distance between nodes



(f) Energy Bands

FIGURE 8: Time compression geometry emerges

Pendulum

By analysing the forces and energies on a dropped ball and then a pendulum allow a more thorough understanding of the compression of time. First, consider a ball held at some altitude within compressed time. The top of ball is in less compressed time and therefore moves more quickly through time. The bottom is in greater compressed time and therefore moves more slowly through time. The energy at time free fall, the rate at which the tennis ball wants to move through time, is equivalent to a band of energy much less compressed time than the ball is currently situated. Therefore the level of T_f is not contained within the mass of the ball.

By providing an external force to hold the ball at altitude, the ball has stored time potential energy, T_p. The T_p at the bottom of the ball is greater than the T_p at the top of the ball. In releasing the ball by eliminating the external force, the ball is not constrained within the area of compressed time and T_p is converted into T_k. The centre of mass of the ball, shown as an '+' in Figure 9, gains motion, which brings the energy at T_f from the initial band of less compressed time, closer and closer to the ball's centre of mass. In the same way as when an object is in orbit, the proportion of the ball that is in less compressed time, C_T, will travel through time more quickly than the portion of the ball contained within a greater C_T. Since there is no external kinetic energy being applied, the process is solely down to T_p being converted into T_k.

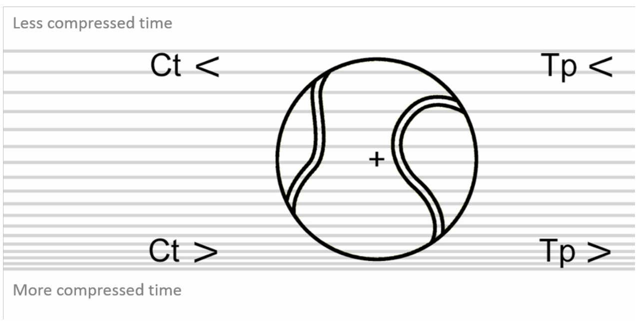


FIGURE 9: Ball in compressed time

Since the ball is only one mass, when in motion, the top of the ball will always be travelling faster in time than the lower portion of the ball. This is in the same way as an object in orbit will have its top portion travelling faster in time than its lower portion, and thereby in effect the top is continuously trying to overtake the lower portions, hence it in the orbital case, it travels in a continuous curve. The ball having no external kinetic energy being exerted upon it, will be forced to move in what is observed to be a downward motion, as the top of the ball tries to overtake the lower half of the ball. Once the ball reaches terminal velocity, the energy at T_f is equivalent to the energy at the ball's centre of mass. In other words, the ball is travelling at T_f.

It is possible to apply the understanding of dropping a ball, to a pendulum. The same principles apply, therefore, again the top of the ball is in less compressed time than the bottom forcing it to travel quicker through time. Therefore, when the ball is dropped from point A in Figure 10, this applies a downward force and converts T_p to T_k. However, since the ball is tethered at a point horizontal to the ball's starting position, the trajectory is continuously pulled to one side. The ball observes its direction in that of '**b**', on Figure 10, however a second observer will view the trajectory as a continuous sequence of tangents '**a**'. This tangential motion is converting the downward motion into a directional kinetic motion.

Once the ball reaches its lowest point, B, T_k is at its greatest, and T_p is at its lowest. If the ball had no sideways momentum, it would stay in its lowest position due to being tethered. However, the ball at this point begins to move back into a lower C_T. When travelling in this tangential trajectory, since from the ball's perspective it is still in a state where the top portion is moving through time more quickly than the lower portion, the downward force of the upper portion will decrease its velocity between points B and C. Therefore, T_p will now start to increase and T_k will decrease to maintain equilibrium and obey the laws of conservation of energy. Due to the conservation of energy the ball cannot reach the same height of travel at the end of each cycle, due to the dissipation of energy caused by the friction of air molecules.

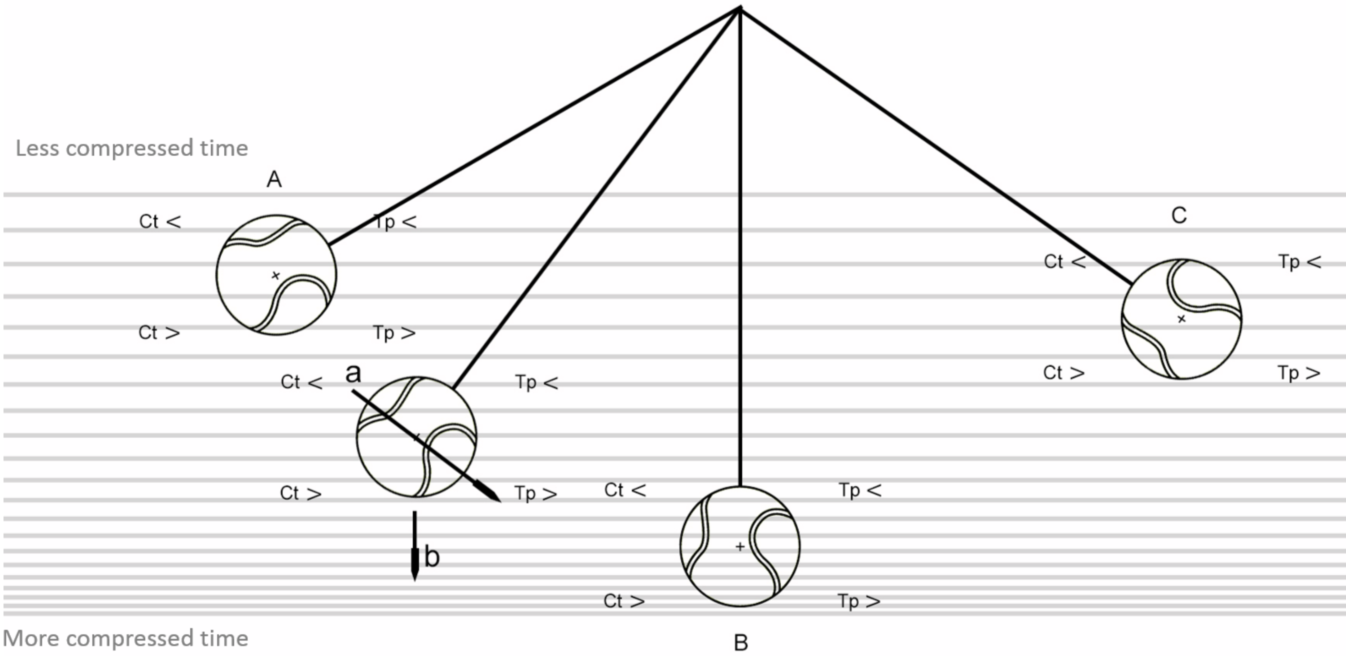


FIGURE 10: Pendulum in compressed time

References

[1] Vanderbei, R. Measuring the Parallax of Barnard's Star. Tech. Report, Nov. 2014. (Princeton University)

[2] Greene, B. The Fabric of the Cosmos: Space, Time, and the Texture of Reality. New York: Knopf. 2004.

[3] Greene, B [Zehadi Alam] (2014, May, 3), Brian Greene on The B-Theory of Time, retrieved from `https://www.youtube.com/watch?v=H1WfFkp4puw`