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THE SPACE-TIME JOURNEY OF SCIENCE AND ORTHODOX CHRISTIAN THEOLOGY

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Abstract

This short research was done in the context of the participation of this paper's author in the *Religion's Lab* of the National and Kapodistrian University of Athens, as well as of her personal search for the conception of the space-time continuum in science and whether Orthodox Christianity embraces the scientific views or if the Patristic Theology 'has spoken' for this issue.

There have been several and different studies on the issue of space-time from a scientific and religious point of view, but one thing is certain: every research project is important so that man can overcome his senses and know the Truth, for which he was created.

This research will primarily analyze the scientific knowledge that exists about space and time, as well as the official view/knowledge expressed by Orthodox Christianity about space-time that influences human existence and of course is explicitly linked to God – Creator's existence.

Keywords: *space-time, Einstein, relativity, universe, Genesis, Hexameron, Basil the Great*.

Introduction

From the dawn of time, mankind has been questioning the meaning of life and studying the nature of the universe. To this day we're still wondering and debating. We are all traveling helplessly through space and time (Crystal Love, 2004). Who are we? Is there a God? Is there a purpose to life? Even from our birth, the concept of time and space is important and related to the health of organisms (Crystal Love, 2004). Considering the process before the birth in the *microcosm* and *macrocosm*, there are many indications that maybe the universe itself has been going through a similar process. Maybe before its birth, it was in a state called pre–birth. And here we are, people with a limited perception and guided by our knowledge of the fields of Physics, Philosophy and Theology, trying to look around and do research at the pre – birth state and the creation of space-time together with the creation of the universe(s). Judeo–Christian Theology confirms large chapters of the science of Cosmology, that relate to the world as a universe with more than seven dimensions. This confirmation exists although we do not have the technology to scientifically prove theories as the superstring theory (Crystal Love, 2004).

In the context of the mystery of the creation of the world, science is trying to answer the question: "How" while Theology to the question "Who". They may be two seemingly different questions, but ultimately the research field is the same and one answer depends on the other exactly like the questions themselves.

With the world's creation, space–time, two dimensions that coexist, had been also created (Crystal Love, 2004). When did this happen? Approximately "*20 billion years ago, our universe was born"* (Crystal Love, 2004, p. 30). The Big Bang Theory explains exactly the creation of the universe. Specifically, everything was contained in a singularity, which is a point where all the laws of Physics break down as we know them.

"*Before the Big Bang and the creation of the material universe, there was no space–time*" (Crystal Love, 2004, p. 105). This is confirmed by modern Physics, Theology and Philosophy of Christianity. So, we concluded to imagine how it is possible for time to exist without time or space without space. In the end, Einstein proved scientists wrong about their perception of time as an absolute dimension.

1. Measuring the time

The effort of measuring time was created along with the beginning of human civilization. In this way, from the beginning of human existence man realized the concept of time (duration) and the role of the repetition of some natural phenomena, so that he could plan his social and productive activities. Later, an example was the Tower of Babel (which we know through the Old Testament), that was essentially a 91 meters high temple dedicated to the god Bel (Marduk), as well as a large observatory, which had excellent observation conditions (Danezis & Theodosiou, 1994). This example also shows the connection between time and religious element.

2. Bernhard Riemann's Geometry

It is known that due to the finite speed of light the images we get of distant galaxies are past. Therefore, there is a good chance that they have already been destroyed (Danezis & Theodosiou, 2012). In this way, the study of the Universe is based on the past images of it that we can receive. Bernhard Riemann (1826–1866) was the one who through his Geometry, explained the concept of the simultaneous existence of two different spheres of events. These spheres are the sphere of the Past and the sphere of the Present. There is information about what the Universe was like in the past while we wait for the future to show us information about what is happening in the present (Danezis & Theodosiou, 2012). So, both events happen at the same time since both spheres coexist. In the field of modern Cosmology, physicists agree that there is no time. Past, present, and future are just an illusion and are encompassing reality (Crystal Love, 2004). The *Theory of Relativity* is since cosmic space is not three–dimensional but obeys Riemann's Geometry. Riemann's space is the so-called space–time continuum, which we cannot divide into two parts: space and time. However, if we could split it in our imagination, the resulting parts would have different properties that the space–time continuum (Danezis & Theodosiou, 2012). This is the reason why we can't have some form of measurement.

3. Hermann Minkowski's Mathematics

In 1908, the great mathematician Hermann Minkowski developed the representation of the *Special Theory of Relativity*, as a four–dimensional pseudo–Euclidean Geometry. From this theory, it ultimately follows that there is no objective division of the world at any moment: past – present – future (Disalle, 2006). He brought a tangent three–dimensional and Euclidean space, in which the events of the four–dimensional

space–time continuum is projected like a mirror, so that they can be perceived by human Physiology. He created this kind of space due to his knowledge that the real forms that exist in the four–dimensional Riemann's space is outside the field of human senses (Danezis & Theodosiou, 2012). Thus, both space and time are studied as independent entities and therefore "shadows" of reality, are really one: the space–time continuum.

4. Relativity

Time is not absolute, but it is relative, and this is something we realized in relation to the speed of light and the speed and position of each observer. "*When we look into deep space, we can look back in time, due to the fact that light takes too long to travel from one place to another*" (Crystal Love, 2004). So, basically, we can see the past. For example, if some conscious beings were on a distant planet and looked back into deepest space, they would see the Earth at the point of its history being relative to their own distance from Earth, of course in terms of light years (Crystal Love, 2004). Although there are many different views of Earth's time, there are all accurate and true. Indeed, as it's proven, we have known for several years now that the farther we observe the Universe, the more ancient / past states we see due to the finite of the speed of light (Svolopoulos, 1972).

We can understand and feel somehow the relativity of time in our daily routine, too. So, in some way we develop a unique relationship with time. Time seems to pass slowly when we're sad or lonely, but fast when we are happy and having a good time. This perception of time is not logical, because it depends on the emotions. However, the perception we view the universe and the way we understand the phenomenon of space–time "is *programmed into our biology*" so we perceive only a small part of space–time and the universe generally (Crystal Love, 2004). We only understand the universe's vibrations, that are happening in the same space–time proximity as ourselves. In other words, we are created to filter the information we receive from the entire universe, so that we can survive in the material or physical world. However, sometimes we can have the ability to see beyond the "normal" / "basic" consciousness. This experience includes a different sense of space–time. An example is the paradoxical phenomenon of time dilation or contraction which is not a simple theory but an experimentally proven phenomenon. In fact, its proof was using particle accelerators. In this experiment it was shown that the lifetime of certain fundamental subatomic particles (*Muons*) can be extended if they are accelerated to higher speed (Danezis & Theodosiou, 2000). *Muons* are a type of heavy electrons produced either naturally (in the upper atmosphere by cosmic radiation), or artificially (through collisions between particles in high energy accelerators). The *Theory of Relativity* as well as experiments proves that the time interval between the creation and decay of the *muon* does not coincide with its lifetime, even if it remains stationary. However, if it moves, its lifetime depends on its speed (Danezis & Theodosiou, 2003). The faster it moves, the longer it lives. The union of space–time creates the concept of a moment in time, which corresponds to a specific point in space.

5. Albert Einstein - Special Theory of Relativity

Special relativity can be considered as the theory, in which spacetime is not based on the Galilean transformations (Disalle, 2006). Time is a relative and not an absolute quantity, the value of which depends on the speed of the observer. Einstein referred to

the unity of space and time and "placed" time to the levels of the fourth dimension (Danezis & Theodosiou, 2000). Time has meaning only when it is connected to the concept of space (space–time continuum). However, the true nature of time cannot be perceived by human senses based on three–dimensional and Euclidean scientific experimentation (Danezis & Theodosiou, 2000). The *Special Theory of Relativity* describes the way we perceive the Universe through our senses and not how it exists. In the human mind, the concepts of space, dimension and curvature are understood through the human senses, Newtonian Physics and Euclidean Geometry (Danezis & Theodosiou, 2012). Contrary to common sense, modern Astrophysics in the field of Cosmology, perceives these concepts through a new scientific understanding. Today we believe that the Universe, which we can observe, is a small part of a larger cosmic unity.

At this point it's worth mentioning that the concept of space is linked to all its physical properties. Their experimental verification in fact, shapes it (space) in the context of human logic (Danezis & Theodosiou, 2012). The space of one dimension consists of a set, corresponding to the length. The space of one-dimension curves in the direction of the second dimension, namely width. "*Correspondingly, a space with two dimensions curves towards the dimension of height". ''When we refer to a curvature of the Euclidean Universe of the three dimensions perceived by our senses, we mean a curvature of it towards the fourth dimension (not time)''* (Danezis & Theodosiou, 2012). But since we cannot perceive this fact with our senses, we replace (within the Cartesian three–dimensional system) the height with the fourth dimension, so that we can have a limited knowledge of the change of the two dimensions. Until today we know that our Universe is curved, which means that there are no straight lines in it, but only curves (Danezis & Theodosiou, 2012).

According to the *Special Theory of Relativity*, the length of an object decreases as its speed increases. When its speed will theoretically have the value of the speed of light, then the length will be zero. Then, the mass of the object will become infinite (Danezis & Theodosiou, 2003). The concept of *Infinity* is one of the oldest philosophical concepts. Of course, this is a concept that cannot be perceived by the human senses, but it is formed through the mind. Something worth mentioning at this point is that according to "Christian doctrine" only God is infinite while the world is somehow "locked" in time (Danezis & Theodosiou, 2012). One can believe in eternity and feel it exist but cannot scientifically prove its existence. In his attempt to prove it, he will realize that he is limited to his brain and his senses (John C. Lilly, M. D., 1975).

6. Albert Einstein – General Theory of Relativity

In the *General Theory of Relativity* is presented a new cosmological model in which time and space are the so–called *space-time*, which is united. Spacetime is heterogeneous, and that's due to the change in the distribution of its matter (Danezis & Theodosiou, 2003).

In fact, the geometry that "governs" the space of the *General Theory of Relativity* according to Einstein, is Riemannian Geometry. Space through our senses is perceived as Euclidean. But if we want to study very large parts of the Universe, Euclidean Geometry stops "working". Accordingly, the Euclidean straight time that we perceive through our watches is not related to the time dimension of the *Theory of Relativity* (Danezis & Theodosiou, 2003).

According to Albert Einstein's *General Theory of Relativity*, what we call *matter* through our senses is nothing more than a region of the three–dimensional space of our Universe that curves into the fourth dimension. The fluctuation of this curvature in Physics is expressed as a change in the density of material energy in a specific area. In fact, this change in the case of the material existence of man is growth and decay (cycle of life). Human physiology cannot perceive the fourth dimension and the curvature of space in it. Nevertheless, it perceives the growth and decay of material energy. To be able to measure them, man invented two fixed units of measurement: the movement of the Earth around itself and its movement around the Sun. The result of these measurements was called *Chronos* (time), a word which comes from the name of the god *Kronos*, who according to the myth was responsible for the cessation of life (death) of a biological system. In conclusion, humanly measured *Time* doesn't measure the fourth dimension and its changes, but the lifetime of a material event. In short, it measures the duration of the local curvature of space, which has such rates, that can be understood by humans (Danezis & Theodosiou, 2012).

Essentially, what the human senses perceive as *matter*, is just the connection of space and time. In the context of Einstein's space-time, matter is not a separate entity, but a singularity of the field (Danezis & Theodosiou, 2000).

The *General Theory of Relativity* is also a theory whose main element is the investigation of phenomena that can be "found" in areas where there are huge gravitational fields. In fact, after research, we know that a very strong gravitational field can bend space. In terms of time, such a field causes it (time) to stop.

Since the times of Newton, we already know that a gravitational field is the result of the existence of a mass in a certain region of space. The intensity of this field is related to the density of the mass. Thus, for the existence of high gravitational fields, the existence of masses with enormous densities is also necessary (Danezis & Theodosiou, 1994). This was of course proven by the modern Astrophysics with the discovery of the "black hole".

According to several studies, time and space do not exist inside a black hole. An imaginary traveler entering a black hole, can move (theoretically speaking) infinitely into the past of the future with zero spatial-time distance (Danezis & Theodosiou, 1994). Essentially, we are talking about a journey through time and space, which is something that has been a part of science fiction for long, but at the same time something about man hasn't said his last word yet.

According to the *General Theory of Relativity*, space and time are two dynamic quantities, that affect and are affected by everything in the universe. Furthermore, it is known that the curvature of space–time changes when a body moves. In fact, there is a mathematical theory, according to which "*positrons can appear to be positrons moving forwards in time, or as electrons moving backwards in time"* (Crystal Love, 2004). Based on this theory, experiments were performed at the University of Nevada by Dean Radin. These experiments showed that the participants "*could distinguish emotionally the sad and happy images that generated randomly by a computer, five seconds before the image itself was transmitted"* (Crystal Love, 2004). Is this a sight that maybe human brain has the ability of traveling both backwards and forwards in time? On the other hand, Quantum Physics supports that everything that is happening in space–time, is happening at the same time. As mentioned above, the separation of time into past, present, and future is just an illusion.

7. The concept of entropy.

As we wanted to describe "time" scientifically, we found out that the only quantity that can be understood by human common sense is *entropy*. *Entropy* is the concept through which we can measure the levels of disorder and disorganization. Therefore, time is often replaced by *entropy* for the sake of understanding when talking about issues such as death. With the passage of time (entropy increase), man grows and finally dies (maximum point of entropy, disorganization: field of thermodynamics). Years before the experimental confirmation of *entropy*, Basil the Great had distinguished it, and finally scientifically it confirmed that the law of entropy directs the decay of beings (Boukis, 2020).

8. The space–time continuum in Orthodox Christian Theology.

The Universe and time are not something outside of our lives. Our existence is space–time itself. We identify ourselves with space–time. For this reason, human nature in terms of measurement is timeless. At this point is based the theory of Christian Theology of man as a creature of God and for God as eternal. It must be understood that basic theological views, whether those referring to God (timeless, eternal etc.) or to human existence (life, death, eternal life, etc.) include at their core the concept of time even negatively.

According to the book of *Genesis* we learn that initially God created the earth and the sky. The concept of beginning denotes the creation of time in the material world. Furthermore, it is worth mentioning that the creation and existence of time also prove the creation and thus the difference between creation and Creator (Totsis, 2011). Also, the creation of beginning proves that the world has a beginning and an end and that it's not eternal as they liked to believe in the past. This movement is interpreted by some scientists as the *Big Bang* that created the universe, as mentioned by Professor M. Dermitzakis in his work "*Geological approaches to the Hexameron of Basil the Great"* (2007). According to Einstein's *General Theory of Relativity*, there is no time without space and vice versa. Therefore, until that moment, time did not exist.

Hexameron of Basil the Great is the most authoritative text that deals with the beginning and the evolution of the world. Also, it contributes to the historical research of "time" (Boukis, 2020). Basil the Great, as one of the most important Fathers of the Orthodox Church, comes in "Hexameron" to the same conclusion as does modern Astrophysics, that time was created together with the visible Universe, that is the three–dimensional Euclidean space (Danezis & Theodosiou, 2000). He considered that there seems to have been something before the creation of our world which is impossible for us to perceive with our minds and it's in fact unsuitable for those with spiritual immaturity. In fact, he states that to find the truth, we should not measure the size of the Moon with the eyes, but with the mind which is more accurate than the eyes (Svolopoulos, 1969). The eyes, like all human senses, are a weakness that we must proclaim.

In the two speeches in ''Hexameron'' Basil the Great refers to the phrase of Genesis "in *the beginning God created..."*, analyzing the concept of "beginning" (*ἀρχῆς*) by developing the mathematical concept of the point, the concept of time, the beginning of time and concludes that it is impossible to have been an infinite beginning of time (Svolopoulos, 1969). Therefore, before the creation of "matter" (the world), there could not have been time, since time is an element connected with matter and its change. Thus, time is a creation. In fact, he doesn't deny the existence of any end in the world, because there is also a beginning (Svolopoulos, 1969). This means of course that the Universe is not infinite or eternal. Thus, Basil the Great

becomes the first philosophical exponent of the *Big Bang* (long before Belgian Abbot and astronomer Georges Lemaitre) and the non – infinite time and space of the Universe. We can base this philosophical view on the following passage of his First Speech of "Hexameron": "*What has begun at some instant in time, it is necessary to end at another instant. If it has a beginning, do not doubt about its end*".

Furthermore, Basil the Great through his first speech stated the position (before St. Augustine) that the pre-universal state was ―regardless of human logic― eternal and timeless. The concept of time is connected to creation, i.e., the material, the finite. Only God is timeless and eternal, and this comes as a contrast to the temporality that characterizes humanity (Matsoukas, 2016). In fact, according to St. Augustine, the concept of meaning is related to the concept of time. Therefore, it didn't exist before the creation of the world, as there was no time then. For God there is not time, but *eternity* (ἀϊδιότης) which is a "state" that it is not identical with *perpetuitas* (αἰωνιότης), nor is it divided into past, present, and future. These views were also based on the words of Basil the Great. The similarity of their views can be found in the following part of Basil's the Great First Speech: "*Or perhaps because the creation took place instantaneously and without any time interference,… nor dimensions…*".

Basil the Great concludes that time is not identified by movement, but it is measured through the phenomenon of decay effect that it creates (*entropy*). According to his beliefs the Universe was created timeless, which means that the concept of time and the Euclidean space that we perceive are a result of Creation (Danezis et al., 1997).

As mentioned above, Saint Augustine took many of the points of view of Basil the Great. He has considered that we can only measure the intervals of time that pass, because the time that has passed cannot longer be measured (Danezis & Theodosiou, 2000).

Another notable element is that time is not identical with motion, but it is the mean by which motion is measured. We conclude that time is a quantity that is measured inside the soul and not outside of it (relativity of time) (Danezis & Theodosiou, 2000). In this way Saint Augustine tried through his Philosophy to analyze the psychological experience of time and by what processes this happens.

St. John of Damascus also had reference in "time" in his theology. He referred to the "ages" (*αἰῶνες*) as the creation of God – Creator (Boukis, 2020). The concept "ages" does not only refer to the various time dimensions, but also to a combination of them. Therefore, this concept can describe the time of the present life but also the state before the creation as well as the "time" after the Resurrection (Boukis, 2020). In this way time the *ages* combine eternity and perpetuity. As John C. Lilly, M. D. says in his book ''Simulations of God, the science of belief'': *''God always was, always has been, is everywhere and always will be''*. This means of course that God has no limits in space and time.

Conclusion

As a conclusion it's clear that the question of space-time is one of many issues where Science confirms Theology and vice versa. The approach to space-time, as beyond a philosophical, theological, and scientific issue, also has political, social, and cultural extensions. It is a very important issue as we ourselves are a part of space-time and it is in turn a part of our mortality. Through this we realize our value, our essence and certainly the concept of relativity that surrounds us.

Despite the debates that sometimes prevail, the agreement between religion and Science is obvious. It is not by chance that the true faith characterizes the great scientists of the natural or human sciences, as they perceive the limits that exist in the human cognition before the "*deification*" or "making divine" (*theosis*) of man; the purpose that researchers should have been to search not "on the surface" but "on the substance". The main question that remains unanswered until it is answered is whether other theological sayings will be confirmed in the future through research. Until then the agreement of religion – science and research on a philosophical and scientific level will give hope to those who believe that the space-time continuum is a creation, like man and characterizes his humanity.

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