Nigerian Journal of Physics (NJP)
ISSN online: 3027-0936
ISSN print: 1595-0611
DOI: https://doi.org/10.62292/njp.v33i4.2024.323
Volume 33(4), December 2024

Time and Space: Myth, Mystery or Puzzle?

*[1]Fwangle, I. I., [1]Okoronka, A. U. and [2]Lawrence, D. F.

[1]Physical Sciences Education Department, Faculty of Education, Modibbo Adama University, Yola.
[2]Physics Education, University of Jos.

*Corresponding author's email: meetfwangle@gmail.com Phone: +2348069651158

ABSTRACT

The concepts of time and space are indispensable in the discourse of nature and human existence in general or more specifically the fields of science and philosophy. This conceptual paper aims to explore the multifaceted nature of time and space, examining whether they are best understood as mythological constructs, mysterious phenomena, or puzzles to be solved. By analyzing philosophical, scientific, and cultural perspectives, the paper seeks to unravel the complexities surrounding these fundamental concepts that shape our understanding of the universe. Findings from this conceptual paper reveals; (i) In Western cultures, time is often seen as a linear progression, a resource that can be 'spent,' 'saved,' or 'wasted.' While African cultures perceive time as a more cyclical or event- based phenomenon. (ii) Time and space can be seen as s puzzle, inviting us to explore the depths and expand our knowledge to unravel the problem of time and space. By bridging cultural narratives, scientific theories, and philosophical inquiries. The paper invites readers to reconsider their assumptions about time and space.

Keywords:
Space-time,
Quantum,
Time and space,
Relativity,
Puzzle.

INTRODUCTION

Physics as the study of matter and energy has always captivated the human mind with its intricate and enigmatic phenomena. Throughout history, scientists have strived to understand the fundamental laws that govern the universe (Heisenberg, 1927; Car, 2015). However, despite significant advancements, there are still numerous mysteries that continue to baffle physicists and ignite their curiosity. This paper will explore some of the most intriguing myths, mysteries or puzzles in physics and delve into the ongoing quest for answers. In Physics, a mystery refer to a phenomenon or concept that is not yet fully understood or explained by current scientific knowledge, mysteries often involve complex phenomenon that defy our current understanding and require further research and experimentation to unravel for example dark matter while a puzzle refers to problems or questions that has a clear solution to explanation based on existing scientific principles and laws, but may require some thoughts and investigation to uncover (Okoronka, 2024).

Concept of Time

Time is a fundamental quantity in physics, and its measurement is crucial for understanding the behavior of physical systems (Davies, 1995; IAU, 2015). Time is a measure of the duration between events, allowing us to understand the sequence and progression of occurrences (Kaku, 2005). It is a fundamental concept that governs our experience of the world. According to the theory of special relativity, developed by Albert Einstein, time is not an absolute quantity but rather a relative one, dependent on the observer's frame of reference (Einstein, 1905). This concept is known as the "relativity of time" and has profound implications for our understanding of the universe. The passage of time can be influenced by factors such as velocity and gravity, as described by the theory of general relativity (Einstein, 1916, Obaje, *et al* 2024). In this theory, time is not a separate entity but rather part of a unified four-dimensional space-time continuum (Hawking, 1988).
Classically time is an objective feature of the universe, flowing at a constant rate (Newton, 1687). The question one may ask is that where is time flowing from and to where? In quantum mechanics time is an emergent property, arising from the interactions of particles and fields (Dirac, 1927). From the various ideas discussed on the concept of time it is possible to support philosophically that time can be viewed as the property responsible for the unfolding of events and from mystery perspective one may say that time is an interruption of infinity (Mbiti, 1969). Time has

dimensions namely; past, present, and future. The past events have occurred before the present moment, present is the current moment, experienced by observers and the future stands for events that are yet to occur, anticipated or predicted (McTaggart, 1908). The practice of measuring and recording time, varies across cultures and historical periods (Landes, 1983). For example, in the Western world time is viewed as linear while the Africans perceive time as cyclical. The influence of time on culture, including the concept of time in different societies and its impact on daily life also varies (Hall, 1959). Hence the need to further probe them for a better understanding.

Concept of Space

Space refers to the boundless, three-dimensional expanse that encompasses all matter and energy (Kaku, 2005). It is a fundamental concept in physics, astronomy, and philosophy. Classically, space is an absolute, unchanging background that provides a stage for physical phenomena (Newton, 1687). In relativity, space is relative, dependent on the observer's frame of reference (Einstein, 1905). From quantum mechanics view point, space is an emergent property arising from the interactions of particles and fields (Dirac, 1927). The dimensions of space are: length which is the distance between two points in space; width described as the distance between two parallel lines or planes in space and height known as the distance between two points in space, measured perpendicular to the length and width dimensions (Kittel, 2005). Philosophers have debated the nature of space, with some arguing that it is a fundamental aspect of reality and others proposing that it is a human construct (Kant, 1781) and the cultural representations of space has been expressed in various ways across cultures, including in art, literature, and architecture (Tuan, 1977).

Similarly, Feynman (1963) opined that space, on the other hand, is the three-dimensional arena in which all physical phenomena occur. It is often described as the "container" for matter and energy, and its properties are essential for understanding the behavior of physical systems. The geometry of space, as described by the theory of general relativity, is not Euclidean but rather curved, with the curvature being determined by the distribution of matter and energy in the universe (Weinstock, 1972). This curvature of space-time is what gives rise to the phenomenon of gravity, as described by Einstein's field equations (Einstein, 1916; Adagba *et al.* 2021).

The purpose of this paper is to visualize the relationships between theories and perspectives on time and space: Myth, Mystery or Puzzle? Which offers a valuable addition, a guide to readers through these complex ideas of physics. Specifically, the objectives of the paper are to: (i) Identify the relationship between time and space viewed from philosophy, physics, and cultural perspectives. (ii) Examine mythological perspectives of the arrow of time and history of space. (iii) Explore time and space from scientific theories regarding them, including relativity, quantum mechanics, and cosmology, to assess their implications for our understanding. (iv) Identify the interconnections and explore the relationships between myth, mystery, and puzzle in the context of time and space, considering how these perspectives can inform one another. (v) Consider reflections that encourage how cultural narratives influence our perception of time and space, contributing to broader discussions on identity and existence.

Methods and Discussion on Time and Space: Myth, Mystery, or Puzzle?

The method adopted for this study is discursive to establish theoretical framework that integrates insights from identified key theories in physics; relativity and quantum theory and philosophy. This conceptual paper explores the intricate and multifaceted nature of time and space, examining them as constructs that can be perceived as myth, mystery, or puzzle. By synthesizing perspectives from mythology, science, and philosophy, the paper aims to provide a holistic understanding of these fundamental concepts that shape human experience and knowledge.

Relationship between Time and Space

Einstein (1905) postulated that (i). Time and space are intertwined, forming a four-dimensional fabric that describes the universe. (ii). Time appears to slow down or speed up, depending on the observer's frame of reference and their relative motion. (iii). Objects appear shorter or longer, depending on the observer's frame of reference and their relative motion. (iv) Relationship between cause and effect, which is influenced by the space-time continuum and the laws of physics. Philosophers have debated the nature of time and space, with some arguing that they are fundamental aspects of reality and others proposing that they are human constructs (Kant, 1781). Again, time and space have been represented in various ways across cultures, including in art, literature, and architecture (Tuan, 1977).

The interplay between time and space is a fundamental aspect of modern physics. In the theory of special relativity, time and space are not independent entities but rather part of a unified space-time continuum (Minkowski, 1908). This means that events in the universe can be described by their position in space and their position in time, forming a four-dimensional space-time. The relationship between time and space is further explored in the theory of general relativity, where the curvature of space-time is determined by the distribution of matter and energy in the universe (Einstein, 1916). This curvature affects the passage of time and the motion of objects, leading to phenomena such as gravitational time dilation and the bending of light (Weinstock, 1972).

Time as a human construct was viewed from the mythical focal point where some argue that time is merely a human invention, a tool to make sense of our experiences and the world around us (Kaku, 2005) while, the misconception of space can similarly be explained by some philosophical and spiritual perspectives which suggest that space is an illusion, and that the universe is ultimately a unified, interconnected whole (Tuan, 1977). Time and space can be seen as myths in the sense that they are human constructs, created to make sense of our experiences and the world around us. Our understanding of time and space is shaped by our cultural, social, and personal backgrounds, which can lead to different interpretations and meanings.

Despite our perception of time as a measurable, linear concept, its true nature remains a profound mystery. Why does time flow in one direction? What is the relationship between time and the laws of physics? (Einstein, 1905). One may ask where time is flowing to if it actually has a direction. Whereas the origins of the universe, including the formation of space and time, are still shrouded in mystery, scientists continue to explore theories, such as the Big Bang, to explain the universe's beginnings (Hawking, 2005). This scientific exploration is research ongoing and yet to have a conclusion.

Time and space remain mysteries in many ways despite our advances in physics and astronomy. There is still much yet to be well-known about the nature of time and space. The origins of the universe, the nature of dark matter and dark energy, and the phenomenon of time dilation are part of the example of the mystery that surround time and space. According to Einstein's theory of relativity, time dilation occurs when objects move at high speeds or are placed in strong gravitational fields (Adagba, *et al.* 2021). This phenomenon challenges our classical understanding of time and space (Einstein, 1905) which is a puzzle solved by scientist after Einstein postulated this theory.

Also, the problem of quantum gravity which arose from reconciling quantum mechanics and general relativity (two theories that describe different aspects of the universe) remains an open puzzle in physics (Rovelli, 2004), the universe's scale and structure from the intricate web of galaxy filaments to the vast expanses of intergalactic space, the universe's scale and structure pose a complex puzzle that scientists continue to explore (Hubble, 1929). Time and space can also be seen as puzzles, with many pieces that need to be fitted together to form a complete picture. Our understanding of time and space is based on theories and models that are constantly being refined and updated as new evidence and observations become available. The puzzle of time and space is complex and multifaceted, requiring input from many different fields of study, including physics, astronomy, philosophy, and mathematics.

The Arrow of Time

Time, as we perceive of it, flows in a particular direction, from the past to future. However, the fundamental laws of physics do not distinguish between the past and the future. In 1918, a German mathematician Emmy Noether shed light on this and that the great conservation laws are mere consequences of deep symmetries of space and time – things that stay the same if our viewpoint changes. A striking property of such symmetries is that they are also symmetries of the void – of an entirely empty universe. Maybe the transition from nothing to something was not such a big deal. Maybe it was simply a change from nothing to the 'structured' nothing of our galaxy-filled Universe. But why did the change happen? The American physicist Victor Stenger pointed to the fact that, as the temperature drops; water turns into structured water, or ice, because ice is more stable. Could it be, he speculated, that the Universe went from nothing to 'structured nothing' because structured nothing is more stable? (Stenger, 2006).

In Western cultures, time is often seen as a linear progression, a resource that can be 'spent,' 'saved,' or 'wasted.' The future is a direct result of present actions, and punctuality is highly valued (Levine, 1997). African cultures do perceive of time as a more cyclical or event-based phenomenon. Overton (1994) examined the arrow of time and the cycle of time in relation to concepts of change, cognition, and embodiment. Time is often seen as something that comes to you, and activities happen when the time is right, not according to a strict schedule (Mbiti, 1969). Asian cultures, particularly in countries like Japan and China, have a complex relationship with time, balancing ancient traditions with modern punctuality demands. The past, present, and future are considered interconnected, and respect for ancestors and future generations influences present-day decisions (Hsu, 2005).

This puzzle, known as the arrow of time, raises questions about the nature of time and the asymmetry of physical processes. Scientists continue to explore this puzzle, seeking a deeper understanding of the fundamental laws that govern our universe. While time seems to flow in a linear fashion in our everyday lives, Jordan (1994) discusses the arrow of time in the context of longitudinal studies and its applications to human events. The theory of relativity introduced by Albert Einstein suggests that time is not absolute but rather relative to the observer's frame of reference. This notion has led to mind-bending concepts such as time dilation and time travel, which continue to puzzle physicists and philosophers alike.

Understanding the true nature of time and its relationship with space remains an ongoing quest in the field of physics. Time, a concept deeply rooted in our everyday lives, remains a profound mystery in physics. The nature of time, its directionality, and whether it is fundamental or emergent are questions that continue to puzzle scientists. Exploring the nature of time could potentially lead to a deeper understanding of the fundamental workings of the universe.

The history of space

As part the fascinating journey that begins with the Big Bang Theory and continues to shape our understanding of the universe, this paper explored the key milestones in the evolution of space, from the birth of the universe to the advancements in modern space exploration. The Big Bang Theory is the prevailing cosmological model that explains the origin of the universe. According to this theory, the universe began as a singularity, a point of infinite density and temperature. Approximately 13.8 billion years ago (Lemaitre, 1927). This singularity expanded rapidly, creating space, time, and matter. This event, known as the Big Bang, marked the beginning of the universe as we know it. In the early stages of the universe, matter was primarily in the form of hydrogen and helium. Over time, gravity caused these gases to come together, forming stars and galaxies. The first stars, known as Population III stars, were massive and short-lived, but their deaths enriched the universe with heavier elements.

As the universe continued to evolve, galaxies formed and merged, giving rise to the diverse structures we observe today. The formation of galaxies also led to the birth of stars like our Sun, which formed within a swirling cloud of gas and dust known as a nebula. These stars, in turn, gave birth to planets, including our own Earth. The study of space has come a long way since ancient civilizations first observed the night sky. In the 20th century, breakthroughs in technology allowed humans to explore space firsthand. The launch of the Soviet satellite Sputnik 1 in 1957 marked the beginning of the Space Age. This was followed by the first human spaceflight by Yuri Gagarin in 1961 and the historic Apollo 11 mission that landed humans on the moon in 1969. Since then, space exploration has expanded to include robotic missions to other planets, such as the Mars rovers and the Voyager spacecraft, which have provided valuable insights into the composition and history of our solar system. The Hubble Space Telescope, launched in 1990, has revolutionized our understanding of the universe by capturing stunning images of distant galaxies and expanding our knowledge of the cosmos. The history of space is a testament to human curiosity and our desire to understand the universe. From the Big Bang Theory to modern space exploration, each discovery has brought us closer to unraveling the mysteries of the cosmos. As we continue to explore and push the boundaries of our knowledge, the story of space will undoubtedly continue to unfold, revealing new wonders and possibilities for future generations.

The Information Paradox of Black Hole

Marcus Chown is an award-winning writer and broadcaster and a former radio astronomer at the California Institute of Technology in Pasadena. He is the author of Breakthrough: Spectacular stories of scientific discovery from the Higgs particle to black holes (Faber, 2022). Black holes, regions of space-time with extremely strong gravitational forces, have long fascinated scientists (Obaje *et al.*2024). However, the existence of black holes raises a paradox known as the information paradox. According to quantum mechanics, information cannot be destroyed, yet black holes seem to violate this principle by swallowing matter and information. Resolving this paradox could provide valuable insights into the nature of space-time and the fundamental laws of physics.

Time and space have long been subjects of fascination and contemplation for philosophers, scientists, and thinkers throughout history. The concept of time, with its linear progression and irreversible nature, seems to govern our lives, while space, with its vastness and infinite possibilities, shapes our understanding of the universe. However, upon closer examination, it becomes evident that time and space may not be as concrete as they appear, but rather, they could be illusions, puzzles, or even mysteries. The notion of time as a linear progression is deep-rooted in our daily lives. We measure time in seconds, minutes, and hours, and organize our schedules accordingly. Yet, when we delve into the realm of physics, we encounter the theory of relativity, which challenges our conventional understanding of time. According to Einstein's theory, time is not absolute but rather relative to the observer's frame of reference (Einstein, 1916). This means that time can be experienced differently depending on one's speed or proximity to massive objects. Thus, the illusion of time as a fixed and unchanging entity is shattered, leaving us with a puzzle to unravel.

The nature of time and space in physics transcends the simplistic classification into myths, mysteries, or puzzles as it embodies elements of all three, evolving through human history from the realm of mythological and philosophical speculation to the forefront of scientific inquiry. Today, these concepts are primarily considered complex puzzles under active investigation in the realm of theoretical and experimental physics, though they retain an air of mystery due to their profound implications and the existence of unanswered questions. This discussion is rooted in the historical and on-going efforts to understand the fabric of the universe and the following perspectives:

Classical Perspectives of Time and Space

Historically, Aristotle viewed time as a series of moments that exist in relation to motion and change, suggesting that without change, time could not be perceived (Aristotle, ca. 350 B.C.E.). Time and space were seen as absolute and separate entities, a perspective that can be traced back to Newton's Principia (Newton, 1687). Newtonian mechanics posited that space is a fixed, unchanging stage upon which physical events occur, and time flows at an unvarying rate for all observers. This view dominated physics for centuries and provided a reliable framework for classical mechanics.

The Relativity Revolution Perspectives of Time and Space

Time is often considered the fourth dimension, a measurable period during which actions, processes and events occur. It is a continuous sequence that moves from the past through the present to the future. The concept of time has been explored by philosophers like Augustine, who pondered its nature and existence, suggesting that time is a construct of the human mind (Augustine, 397), while Space is the boundless three-dimensional extent in which objects and events have relative position and direction. Physical space is often conceived in three linear dimensions, although modern physicists usually consider it, with time, to be part of a boundless four-dimensional continuum known as space-time. The concept of space is considered to be of fundamental importance to an understanding of the physical universe. The philosopher Kant argued that space is a fundamental a priori intuition, which allows us to comprehend the structure of the physical world (Kant, 1781).

Also, in physics, space-time is any mathematical model that combines space and time into a single continuum. Space-time diagrams can be used to visualize relativistic effects such as why different observers perceive where and when events occur differently. Einstein's theory of general relativity states that space-time is curved and distorted by mass and energy (Einstein, 1915). The advent of Einstein's theories of Special relativity (1905) and General Relativity (1916) fundamentally altered our understanding of time and space, revealing them to be dynamic and intertwined aspects of a single entity: space-time. In his ground-breaking paper "On the Electrodynamics of Moving Bodies," Einstein (1905) demonstrated that the measurements of time and space are relative to the observer's state of motion, challenging the notion of their absoluteness. General Relativity further complicated this picture by showing how mass and energy curve space-time, affecting the motion of objects and the flow of time (Einstein, 1916). These theories moved the discussion of time and space from the realm of philosophical speculation to precise scientific inquiry, DeLong (1981) discussed phenomenological space-time and experimental approaches to relativity, contributing to the empirical understanding of these concepts. Arthur (2021) provides fresh interpretations of Leibnitz's theories of time, space, and the relativity of motion, which have been influential on Einstein's work, turning these concepts into puzzles with specific, testable implications. McDonough reviewed Arthur's work, highlighting the complexity of Leibnitz's theory of time and its implications for understanding relativity (McDonough, 2021).

Controversial Experiments Related to Time Travel

In the 1980s, there were reports of another controversial time travel experiment, the Montauk project, which allegedly experimented with time travel among other things. Whether the Philadelphia and Montauk experiments actually took place is still under debate. However, it is common sense to assume that the military would definitely be interested in the possibility of time travel and would engage in extensive research on the subject. In 2004, Marlin Pohlman, a scientist, engineer, and member of Mensa with a Bachelor, MBA and PhD, applied for a patent for a method of gravity distortion and time displacement. In 2013 Wasfi Alshdaifat filed another patent for a space compression and time dilation machine that could be used for time travel.

Quantum Mechanics and Beyond Perspectives of Time and Space

Quantum mechanics introduced yet another layer of complexity by describing phenomena that do not fit neatly into the space-time framework of relativity, such as entanglement and the uncertainty principle, discussions treating time and space as quantum degrees of freedom in Hilbert space, which leads to emergent features of temporal and spatial translations in relativistic quantum mechanics (Singh, 2022). These aspects suggest that on the smallest scales, the nature of time and space may differ significantly from our classical and relativistic understandings. Theoretical efforts to reconcile quantum mechanics with general relativity, such as string theory and loop quantum gravity, propose that space-time may have a discrete structure at the Planck scale (Rovelli, 2004; Greene, 1999). These theories are at the forefront of current research, representing the latest part in the ongoing effort to solve the puzzle of time and space.

This conceptual paper explored the concept of time and space, examining whether they are a myth, puzzle, or mystery and has portrayed time as the progression of events from the past, through the present, and into the future. It is a fundamental aspect of our existence, governing our daily lives and shaping our experiences. On the other hand, space refers to the three-dimensional extent in which objects and events occur. It provides the framework within which everything in the universe exists. One perspective suggests that time and space is merely human constructs, created to make sense of our surroundings. According to this view, time and space are not inherent properties of the universe but rather concepts that can be used to organize and measure our experiences. From this standpoint, time and space can be considered as myths, and creations of our collective imagination.

In spite of the advancements in scientific knowledge, many questions about time and space remain unanswered. The concept of time, for instance, raises profound philosophical and metaphysical questions. Is time linear or cyclical? Precisely when did time begin and when is it likely to end? These questions continue to perplex us, hinting at the mysterious nature of time and its elusive essence. However, scientific theories such as Einstein's theory of relativity challenge this notion. Einstein proposed that time and space are intertwined, forming a four-dimensional fabric known as space-time. According to this theory, gravity warps space-time, causing objects to move along curved paths. This revolutionary idea suggests that time and space is not mere illusions but rather fundamental aspects of the universe which utilize quantum mechanics and quantum probability theories to present a quantum approach to time and organizational change, suggesting that the future exists in a state of potentiality that collapses to form the present (Lord et al., 2015; Adagba *et al.* 2021). From these perspectives, time and space can be seen as puzzles, inviting us to uncover their intricacies and understand their underlying mechanisms. Similarly, the vastness of space and the mysteries it holds captivate our imagination. The exploration of distant galaxies, black holes, and the origins of the universe reveal the boundless wonders of space. As we uncover more about the cosmos, we realize that there is still much that we do not know. The conundrum of space invites us to delve deeper, to unravel its secrets and expand our understanding of the universe.

CONCLUSION

Time and space in physics, are best characterized as complex puzzles imbued with elements of mystery. While significant progress has been made in understanding these fundamental aspects of the universe, particularly with the development of relativity and quantum mechanics, complete and unified theories remain elusive for now. This conceptual paper indicated different perspectives as deduced below: (i) In Western cultures, time is often seen as a linear progression, a resource that can be 'spent,' 'saved,' or 'wasted.' While African cultures perceive of time as a more cyclical or event- based phenomenon. Secondly, a German mathematician Emmy Noether, stated that things may stay the same way if our view point changes. This probably explains why the fundamental laws of Physics do not distinguish between past and the future. Again, the search for a deeper understanding of time and space continues to challenge physicists, promising to unveil new mysteries and puzzles in the fabric of the cosmos. Also, the nature of time and space is a complex and multifaceted subject. While some argue that they are mere constructs of the human mind, scientific theories and unanswered questions suggest otherwise. Lastly time and space can be seen as s puzzle, inviting us to explore the depths and expand our knowledge to unravel the problem of time and space. Time and Space: Myth, Mystery, or Puzzle? is a thought-provoking and well-researched conceptual paper that contributes significantly to the discourse on these two fundamental concepts. By bridging cultural narratives, scientific theories, and philosophical inquiries, it invites readers to reconsider their assumptions about time and space. The interdisciplinary approach not only enriches the discussion but also opens avenues for future research and the journey of exploration continues to inspire scientific investigation, philosophical debate, and human curiosity.

REFERENCES

Adagba, G., Oshimagyel, I. G., Alagbe, G. A., & Ayantunji, B. G. (2021). Effects of space weather parameters on agricultural produce. *Nigerian Journal of Physics, 30* (2), 68 -76. *Retrieved from* https://nip.nipngr.or/index.php/article/view/96

Aristotle. (ca. 350 B.C.E.). *Physics. URL: The Internet Classics Archive | Physics by Aristotle*

Arthur, R. T. W. (2021). *Leibniz on time, space, and relativity*. Oxford University Press. https://doi.org/10.1093/oso/9780192849076.001.0001

Augustine. (397). *Confessions. URL: AUGUSTINE: CONFESSIONS* - Georgetown University

Bertone, G. (2010). *Particle dark matter: Observations, models and searches.* Cambridge University Press. https://doi.org/10.1017/CBO9780511770739

Carr, B. (2015). Higher dimensions of space and time and their implications for psi. *In E. C. May & S. B. Marwaha (Eds.), Extrasensory Perception: Support, Skepticism, and Science* (pp. 21–61). Praeger/ABC-CLIO.

Davies, P. (1995). *About time: Einstein's unfinished revolution*. Simon & Schuster. *URL: Higher dimensions of space and time and their implications for psi*

DeLong, A. J. (1981). Phenomenological space-time: Toward an experimental relativity. *Psychological Bulletin, 91*(1), 128. https://doi.org/10.1037/0033-2909.91.1.128

Dirac, P. A. M. (1927). The quantum theory of the electron. *Proceedings of the Cambridge Philosophical Society, 23*, 136-145. https://doi.org/10.1017/S0305004100011912

Einstein, A. (1905). On the electrodynamics of moving bodies. *Annalen der Physik, 17*(10), 891-921. *URL: On the Electrodynamics of Moving Bodies*

Einstein, A. (1915). *Relativity: The special and general theory*. *URL: Relativity: The Special and General Theory*

Einstein, A. (1915). The Foundation of the general Theory of relativity. Annalen der Physik, *354*(7), 769-822.

Einstein, A. (1916). *The Foundation of the general Theory of relativity.* Annalen der Physik. https://doi.org/10.1002/andp.19163540702

European Space Agency. (n.d.). The universe: From the Big Bang to today. Retrieved from https://www.esa.int/kids/en/learn/Our_Universe/The_Universe_from_the_Big_Bang_to_todays

Faber, M (2022). A geometric electrodynamic phenomena. *Universe, 8*(73). https://doi.org/10.3390/univers8020073

Feynman, R. P. (1963). *The Feynman lectures on physics (Vol. 1)*. Addison-Wesley. *URL: The Feynman Lectures on Physics Vol. I*

Greene, B. (1999). *The elegant universe: Superstrings, hidden dimensions, and the quest for the ultimate theory*. W. W. Norton & Company. *URL: The Elegant Universe*

Greene, B. (2004). *The fabric of the cosmos: Space, time, and the texture of reality.* Vintage Books. *URL: The Fabric of the Cosmos*

Hall, E. T. (1959). *The silent language.* Doubleday. *URL: The Silent Language*

Hawking, S. W. (1988). *A brief history of time: From the big bang to black holes.* Bantam Books. *URL: A Brief History of Time*

Hawking, S. W. (2005). *A brief history of time: From the big bang to black holes*. Bantam Books.

Heisenberg, W. (1927). *Über den anschaulichen Inhalt der quantentheoretischen Kinematik und Mechanik. URL: Über den anschaulichen Inhalt der quantentheoretischen Kinematik und Mechanik*

Hsu, E. Y. (2005). On structure of space-time. Physics Essays Publication 18(4), pp 565+ https://physicsessays.org

IAU (2015). *Astronomical constants*. International Astronomical Union.

Jordan, T. E. (1994). The arrow of time: Longitudinal study and its applications. *Genetic, Social, and General Psychology Monographs*, *120*(4), 469–531.

Kaku, M. (2005). *Parallel worlds: A journey through creation, higher dimensions, and the future of the Cosmos*. Doubleday.

Kant, I. (1781). *Critique of Pure Reason.* Translated by J. M. D. Meiklejohn.

Kittel, C. (2005). *Introduction to solid state physics*. John Wiley & Sons.

Landes, D. S. (1983). *Revolution in time: Clocks and the making of the modern world*. Harvard University Press.

Lemaitre, G. (1927). *A homogeneous universe of constant mass and increasing radius accounting for the radial velocity of extra-galactic Nebulae*.

Levine, A. (1997). How the academic profession is changing. *Journal of Beogradski Krug*, *4*(2), 92-99.

Lord, R. G., Dinh, J. E., & Hoffman, E. L. (2015). A quantum approach to time and organizational change. *The Academy of Management Review, 40*(2), 263–290.

Mbiti, J. S (1969). *African religions and philosophy. Second edition and enlarged edition.* I.H.D (h.c. Barringston. R I U. S. A), and D. theo. (h.c Lannsanne Switzerland)

McDonough, J. (2021). *Review of Ric Arthur's Leibniz on time, space, and relativity.* The Philosophical Review.

McTaggart, J. M. E. (1908). The Unreality of Time. *Mind, 17*(68), 457-474.

Minkowski, H. (1908). Space and time. *Physikalische Zeitschrift, 10,* 104-111.

NASA. (n.d.). The big bang: A history of the universe. *Retrieved from* https://science.nasa.gov/astrophysics/focus-areas/what-powered-the-big-bang

National Geographic. (n.d.). space exploration. *Retrieved from* https://www.nationalgeographic.org/encyclopedia/space-exploration/

Newton, I. (1687). *Philosophiæ naturalis principia Mathematica*. (Available from Classics Archive)

Newton, I. (1687). *Philosophiæ Naturalis Principia Mathematica*. Royal Society.

Obaje *et al.* (2024). Rieman's acceleration in light of the Howusu metric tensor in polar coordinates and its effects on the theory of gravitation. *Nigerian Journal of Physics (NJP) 33*(1), 56 – 59. *DOI:* https://doi.org/10.62292/njp.v33i1.2024.200

Okoronka, A.U (2024). *SED 785: Issues and problems in teaching & learning of physics M.Sc. Ed Physics lecture notes*. Physical Sciences Education Department, Faculty of Education, Modibbo Adama university Yola.

Overton, W. F. (1994). The arrow of time and the cycle of time: Concepts of change, cognition, and embodiment. *Genetic, Social, and General Psychology Monographs, 120*(4), 469–531.

Reichenbach, H. (1956). *The direction of time.* University of California Press.

Ridderinkhof, K. R., Wylie, S. A., van den Wildenberg, W. P. M., Bashore, T. R., Jr., & van der Molen, M. W. (2021). The arrow of time: Advancing insights into action control from the arrow version of the Eriksen flanker task. *Attention, Perception, & Psychophysics, 83*(2), 700–721. https://doi.org/10.3758/s13414-020-02167-z

Rovelli, C. (2004). *Quantum gravity*. Cambridge University Press.

Singh, A. (2022). Quantum space, quantum time, and relativistic quantum mechanics. Quantum Studies: *Mathematics and Foundations, 9,* 35–53.

Stenger, V. J. (2006). *The comprehensive cosmos: Where do the laws of physics come from? (p. 215).* Prometheus Books.

Tuan, Y. F. (1977). *Space and place: The perspective of experience*. University of Minnesota Press.

Weinstock, R. (1972). *General relativity and gravitation.* John Wiley & Sons.