International Journal of Current Science Research and Review
ISSN: 2581-8341
Volume 06 Issue 06 June 2023
DOI: 10.47191/ijcsrr/V6-i6-52, Impact Factor: 6.789
IJCSRR @ 2023
www.ijcsrr.org

Evaluate the Mystery of Creation of Universe and Existence of Antimatter, Dark Matter and Dark Energy

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ABSTRACT: We know relatively little about the cosmos. What we know about what we don't know is even more tenuous. Antimatter is just matter with some properties swapped, such as electric charge. The positron serves as the antimatter counterpart to the electron, displaying a remarkable similarity in mass while possessing contrasting electric charges. Antimatter differs from regular matter in that it annihilates when it collides with regular matter. For instance, a proton and a positron have a lot in common. Both of them are of regular mass. They each possess a positive electric charge of equal strength. They both have one-half quantum spin. When a proton and an electron collide, a stable hydrogen atom is produced. When a positron and an electron collide, they destroy each other. The main distinction is that a positron is antimatter while a proton is matter. Knowledge dark matter and dark energy is critical for gaining a fundamental knowledge of the shape, structure, and properties of our Earth, galaxy, and universe. By fitting a theoretical model of the universe's composition to the combined set of cosmological measurements, scientists found that the cosmos has around sixty-eight percent of dark energy, twenty-seven percent of dark matter, and five percent of normal matter. We should never touch our anti-self because we will perish if we do. It is a thoughtful and analytical article that draws on the knowledge and insight of scientists, physicists, technologists, and inventors about how the universe, dark energy, dark matter, antimatter and matter were formed. This knowledge will help in the development of new technologies for the civilization and prosperity of our precious planet Earth.

KEY WORDS: Antimatter, Annihilation, Big Bang, dark matter, dark energy, degenerate matter, exotic matter.

INTRODUCTION

1. The universe is the most enigmatic creation of the Almighty or God. Another greatest enigma is how it was created and managed with such strict discipline. Today's wise individuals are aware that there is more mystery than knowledge in the cosmos. One aspect of the universe's expansion was largely understood in the 1990s. It may have an energy density sufficient to halt its expansion and cause it to collapse, or it could have an energy density so low that it would never stop expanding. But as time passed, gravity would inevitably slow the expansion. We planned for the universe to slow, even if it had not yet been noticed. The gravitational attraction of all matter in the universe brings it all together. The Hubble Space Telescope[1] (HST) first revealed in 1998 that the cosmos was expanding more slowly than it is now due to observations of extremely far-off supernovae. As a result, contrary to what we previously believed, the universe's expansion has actually been accelerating. Nobody anticipated this and had an explanation for it. There was undoubtedly a reason. Finally, three different types of explanations were developed by scientists and thinkers. Perhaps it was a product of the cosmological constant, a long-forgotten interpretation of Einstein's theory of gravity. Perhaps there was a peculiar type of energy fluid filling the air. Alternately, there might be a flaw in Einstein's theory of gravity, and a new theory might incorporate a field of some sort that causes this cosmic acceleration. What is the most appropriate theory, which theorists are still unsure of? It's interesting that there was a solution, and it was called dark energy. Nothing except mystery surrounds it. According to scientists, dark energy makes up around 68% of the universe. Dark matter, however, makes up around 27% of the universe. [2]Only 5% of the cosmos is made up of the remaining regular matter, including everything else on Earth.

2. The idea that dark energy is a quality of space is one way to explain it. The concept that empty space is not nothing but rather full of something was originally understood by Albert Einstein. Amazing characteristics of space exist, many of which are only now being fully comprehended. The first characteristic that Einstein identified is the ability for new space to be created. Then, a second prediction is made by one interpretation of Einstein's theory of gravity, the interpretation that includes a cosmological constant: empty space can have its own energy. This energy would not be diminished as space expanded because it is a characteristic

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of space itself. There will be more of this energy of space as more space is created. This kind of energy would lead the cosmos to keep growing as a result. [3] Unfortunately, nobody knows why the cosmological constant should exist in the first place, much less why it would have the precise number necessary to explain the universe's observable acceleration. The quantum theory of matter offers another explanation for how energy is acquired in space. According to this hypothesis, the vacuum is actually filled with transient (virtual) particles that continuously develop and vanish. The calculation used by physicists to determine how much energy this would release into empty space was incorrect, though. The result was 10^{120} times too large. Getting an answer that poorly is difficult. The enigma therefore endures.

3. A different theory for dark energy is that it is a brand-new type of dynamical energy fluid or field that covers all of space but has an opposite impact on the universe's expansion to that of matter and regular energy. This quintessence was given the name of the fifth element of the Greek philosophers by some theories. If quintessence is the solution, we still don't understand what it entails, how it works, or why it exists. The enigma thus grows deeper. The possibility that Einstein's theory of gravity is incorrect is a final one. That would have an impact on the behavior of ordinary matter in galaxies and clusters of galaxies, in addition to the universe's expansion. This fact would provide us a mechanism to determine if a new gravity theory is the answer to the dark energy problem or not: we could look at how galaxies form clusters. But what kind of theory would be needed if it turned out that a new one of gravity was required? How could it offer us the alternative prognosis for the universe that we require while accurately describing the motion of the solar system's bodies, as Einstein's theory is known to do? There are potential explanations, but none are convincing. The enigma therefore endures. More data and better data are required to make a decision between various dark energy hypotheses, such as a spatial property, a novel dynamic fluid, or a novel theory of gravity.

4. The unusual nature of antimatter is not as portrayed in science fiction or other explanations. In reality, antimatter has a regular mass and responds to forces by accelerating similarly to ordinary matter. Like regular matter, antimatter is gravitationally drawn to every other particle in existence as well as to other types of matter. On the other hand, antimatter has a counterpart in the form of some particles, including photons, which are also antiparticles of themselves. What happens when antimatter interacts with its ordinary matter is the next question. The answer is that they mutually destroy one another, converting all of their mass into enormous energy. This principle of mutual annihilation between matter and antimatter has been seen numerous times. We already know that a positron emission tomography[4] (PET) scan is an imaging procedure that can help show how our tissues and organs work metabolically or biochemically. It's interesting to note that annihilation events are frequently used in medical science[5] to create images of individuals in PET scans.

5. Positive energy density and pressures or tensions that are consistently smaller than the energy density are characteristics shared by all recognized types of matter. The energy density in a stretched rubber band is 100 trillion times more than the tension. Exotic stuff is a more intriguing concept. A hypothetical type of stuff known as exotic matter has a negative energy density as well as a negative pressure or tension that is greater than the energy density. The behavior of some vacuum states in the quantum field theory is a potential source of exotic matter. Stable wormholes and the Alcubierre warp drive[6] may be made feasible if such matter is actually present or has the ability to be generated. Cosmologists are interested in the strangest types of exotic matter, which is mysterious dark matter. This is largely believed to pervade galaxies and is expected to be some type of exotic particle distinct from the protons, neutrons, and electrons that comprise standard matter. [7] Baryonic matter should only include baryons or protons, neutrons, and all items made up of them or atomic nuclei, but not electrons and neutrinos, which are actually leptons. Astronomers use the term 'baryonic' to describe to all objects composed of conventional atomic matter, ignoring the presence of electrons, which account for only 0.0005 of the mass. Neutrinos, on the other hand, are thought to be non-baryonic. Clouds of frigid gas, planets, comets and asteroids, stars, neutron stars, and black holes are all examples of baryonic matter objects in the cosmos.

6. Surprisingly, the vast majority of dark matter in the cosmos is non-baryonic and thus composed of one or more unusual matter types. The only constraint on dark matter's identity is that it is non-baryonic. [8] Degenerate matter, once again, is that special substance whose properties are dictated by quantum mechanics. This matter can act significantly differently than the stuff we are used to. However, degenerate matter is the inverse of stuff that obeys the ideal gas law. Under the immense pressures of highly thick

planetary remains[9], matter degenerates. Antimatter is now the stuff of science fiction. Professor Langdon attempts to defend Vatican City from an antimatter bomb in the science fiction novel and blockbuster film "Angels and Demons." Star Trek's Enterprise uses matter-antimatter annihilation propulsion to go faster than light. [10] However, antimatter is also a component of reality. Antimatter particles are nearly identical to matter particles, except that they have the opposite charge and spin. When antimatter collides with matter, they instantly annihilate into energy. So, anything but matter is a mystery, and we should endeavor to understand it to better grasp the cosmos and the story behind its creation. Actually, it is an analytical article based on the thoughts and wisdom of scientists, physicists, technologists, and inventors about the creation of matter, antimatter, dark matter, dark energy, and the universe, as well as future advanced technological inventions; which will help to brainstorm further for future technological inventions for the civilization and prosperity of our beloved earth.

MATTER AND ANTIMATTER

7. Everything we can see around us is made of matter, which is a phrase used to define a substance with characteristics like mass and volume. The Paul Exclusion Principle[11] explains the formal description of particle physics. At its most basic, matter is any field, such as an electron, quark, or neutrino, in which particles and antiparticles are accessible, but there is a limit to how much of a field can be present at any given time. Nothing is infinitely dense because of this. Although the idea of matter is frequently known and taught at a basic level, the universe as we know it is largely composed of two types of matter: antimatter and dark matter, which are sometimes confused but have separate properties. Although these two phrases are frequently used interchangeably, they have unique definitions that are equally significant to the universe. When antiparticles are bonded, they exist with the ever-permeating quantum forces and are referred to be antimatter[12].

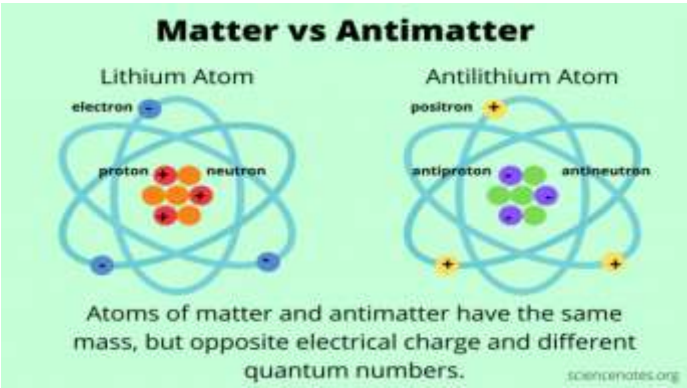

Figure 1: Atoms of matter and antimatter have same mass[13]

8. Antimatter is made up of the same elements as matter but has an opposing charge. For example, the electron is a very small particle that emits a negative charge; the anti-electron, also known as the positron, has the same mass and spin as the electron but emits a positive charge instead of a negative one. Surprisingly, when these anti-particles combine, they form antimatter. Antimatter can create anti-oxygen, anti-mountain, anti-iPhone, anti-planet, anti-human, and anti-plant molecules, among other things. According to certain theoretical physicists' research, antimatter even theorizes that entire galaxies are made up of antimatter; this means that there could be beings that are similar to us, but opposite. After learning all of this new information, the most pressing concern is, why haven't we seen any anti-mountains? One reason is that light is the natural source of antimatter. Natural occurrences include cosmic ray impacts, gamma rays from thunderstorms, and radioactive decay of potassium-40. Surprisingly, when we eat a banana, we consume trace amounts of antimatter. When an antiparticle collides with its counterpart, it annihilates into nothing and emits energy equal to the antiparticle's and its own energy. This phenomena is analogous to the sum of 4 and -4 being equal to 0. They cancel each other out, resulting in total destruction. That is why there are so few things in the cosmos. One of the physics' unsolved puzzles is the baryon asymmetry, which is an inequality[14]. The energy contained in the matter and antimatter are combined to produce a significant amount of light as a result of this reaction, which is nevertheless subject to the law of conservation of energy. Scientists and physicists should investigate antimatter because, despite having many similarities to observed matter, its atomic

structure is slightly different from that of matter as we understand it, and both they and we are interested in learning why and what the solution to this riddle is.

DARK MATTER AND DARK ENERGY

9. Dark matter is the force that aids in the universe's regulation if antimatter is our equivalent. The term "missing matter" was used by Swiss-American astronomer Fritz Zwicky to describe the recently discovered kind of stuff known as "dark matter." This was initially seen when Zwicky determined that the combined mass of all the stars in the Coma clusters of galaxies was only 1% of the mass required to escape the gravitational attraction of the Coma clusters. When Vera Rubin and W. Kent noticed that our galaxy's spiral is proportionate to 10 times more matter than we can see or calculate, they made a similar observation, which led to the discovery of dark matter[15]. The dark matter is invisible since it doesn't respond electromagnetically and can't be observed with light. But it reacts gravitationally, bending light around it as massive blobs of dark matter, so we know it exists. On the other side, humans are unable to observe, measure, or detect dark energy. However, we can define it as the phenomena responsible for the universe's quickening expansion. It is the innate vitality of space's emptiness. The universe is expanding because empty space only produces more empty space. This void is still growing and contains more energy than all we know combined. Understanding our universe and how we got here requires research into dark matter and dark energy.

DIFFERENCES BETWEEN ANTIMATTER, DARK MATTER, DARK ENERGY

10. Dark matter is a whole new type of matter, and this is where the characteristics of dark matter and antimatter differ. Since antimatter has the opposite charge to that of observable matter, it cannot interact with matter in a useful way. Gravitational forces, which can be thought of as the matter's tying force, are how dark matter interacts with matter. Dark energy, which characterizes the expanding universe, drives stuff away. Very little of the cosmos is known to us. Again, the gap between what we know and what we don't know is growing. To have a fundamental grasp of the form, composition, and characteristics of our planet, our galaxy, and our universe, it is critical to comprehend dark matter and dark energy. Theorizing various sorts of matter will eventually lead to a conclusion that fundamentally alters how we perceive space. All of these are just theories, though. These attributes have names that we have given them, but they are so vague that we are unsure of anything. Because dark matter interacts primarily to gravity, and gravity is a relatively weak force, even its basic principles are so young that manipulating it is not even theoretically possible. We must always keep in mind that touching our anti-self will lead us to die immediately[16] .

TYPES, PROPERTIES AND EXAMPLE OF DIFFERENT NOT MATTER

11. In our universe, antimatter is much more uncommon than ordinary matter. It is surprising to learn that antimatter exists in minute quantities throughout the natural world, including inside of our bodies. Many different types of radioactive decay, such as the decay of potassium-40, can produce antimatter. As an illustration, when we eat a banana, we actually consume traces of antimatter and create atoms. Our health is not significantly impacted by the amount because it is so little. It is still there, though. The next issue is: Why doesn't antimatter accumulate inside of us? The fact that normal matter makes up the majority of our cosmos is the key, is the answer. Because of this, antimatter cannot last for very long before it collides with conventional matter and is destroyed once more. In addition, cosmic rays and lightning can create antimatter. It is anticipated by conventional particle physics theories and is well understood by scientists and physicists.

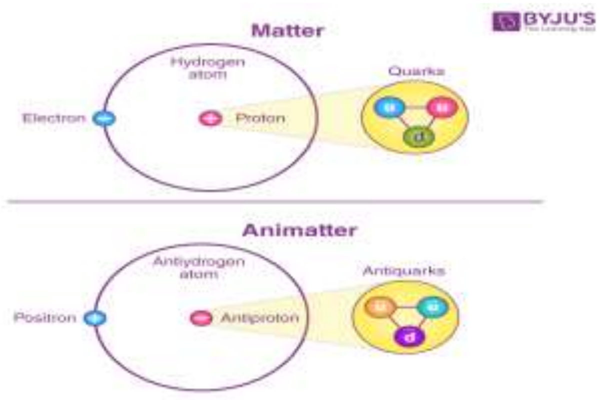

Figure 2: Difference between matter and antimatter[17]

12. Dark matter is a part of the universe that can be identified by its gravitational pull rather than by its brightness. Dark energy makes up the remaining 70% of the universe's matter-energy makeup, while dark matter makes up 30%. Dark matter is matter that doesn't interact with electromagnetic fields and can't be seen with the naked eye. Once more, dark matter interacts gravitationally and is therefore visible through the gravitational pull it has on other matter. It is prevalent throughout the cosmos and aids in the formation of galaxies. Recent estimations indicate that dark matter is actually five times more prevalent in our universe than ordinary stuff. We cannot physically touch, perceive, or manipulate dark matter because it does not interact electromagnetically. In theory, we could control dark matter by applying gravitational forces. The issue then becomes that the gravitational pull is so weak that planet-sized masses are required in order to gravitationally influence objects that are the size of people. Dark matter is difficult to detect and manipulate[18], thus there is still a lot we don't know about it. Although dark matter is an essential component of the Big Bang theory, it is not anticipated nor explained by conventional particle physics models. But researchers remain optimistic that they will solve the puzzle.

13. On the other hand, dark energy, which is energy on a cosmic scale, is pushing galaxies away and accelerating the expansion of the universe. Similar to dark matter, dark energy is not immediately observable by conventional methods and is also poorly understood[19]. Our cosmos is clearly expanding, as shown by a number of different pieces of evidence. Our universe is enlarging faster and faster. And the poorly understood mechanism that fuels this quickening expansion is known as dark energy. Dark energy tends to push matter apart, whereas dark matter tends to draw matter together. Since dark matter and conventional matter have little gravitational attraction to one another, dark energy is feeble and generally only exists at the intergalactic scale. The universe is thought to be covered in dark energy, which is distributed uniformly but delicately. Standard particle physics theories cannot predict or explain dark energy, but contemporary iterations of the Big Bang theory do. The relationship between dark energy and the vacuum energy predicted by particle physics is still unclear.

Figure 3: Dark matter appears to be spread across the cosmos in a network like pattern, with galaxy clusters forming at the nodes where fibers intersect[20]

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14. Regular stuff that has been squeezed to the point where the atoms disintegrate and the particles lock into a massive mass is known as degenerate matter. Usually, degenerate matter is represented by an ideal Fermi gas. The Pauli Exclusion Principle applies enormous pressure in addition to, or instead of, thermal pressure in this extremely dense state of fermionic matter. The definition applies to matter made up of fermions such as electrons, protons, and neutrons. Generally speaking, the word is used in astronomy to describe dense star objects where the gravitational strain is so intense that quantum mechanical effects are noticeable. In stars in their terminal stages of evolution, this kind of stuff is naturally present. [21] Degenerate matter behaves somewhat like a gas in that the particles are not connected to one another, and somewhat like a solid in that the particles are packed so tightly that they are unable to move much. The majority of a white dwarf star's mass is made up of electrons condensed into degenerate matter. Degenerate neutrons make up the majority of a neutron star's mass. A neutron star may become a quark star—a star made of quarks in a degenerate state—if it is compressed further. However, not enough is known about quarks to say if they are possible or even exist right now. [22] Exotic matter[23] refers to hypothetical particles and states of matter with unusual physical characteristics that defy accepted physical principles, for as a particle with a negative mass. Undiscovered hypothetical particles and states of matter, if discovered, would have attributes consistent with accepted theories of physics[24]. High pressure applied to common materials can cause significant changes in their chemical or physical characteristics[25].

15. In summary, we can give the electron, proton, neutron, etc. as examples of regular matter. It creates atoms, molecules, things, planets, galaxies, people, animals, insects, and other living things. It is reflective of light and has an infrared signature. Positron, antiproton, and other forms of antimatter are examples. Both ordinary stuff and light are destroyed by it. There is no known example of dark matter. It gives galaxies more bulk but does not reflect light like matter or antimatter does. Degenerate matter examples include neutron stars, quark stars, etc. It creates dense stars and acts like substance to reflect light.

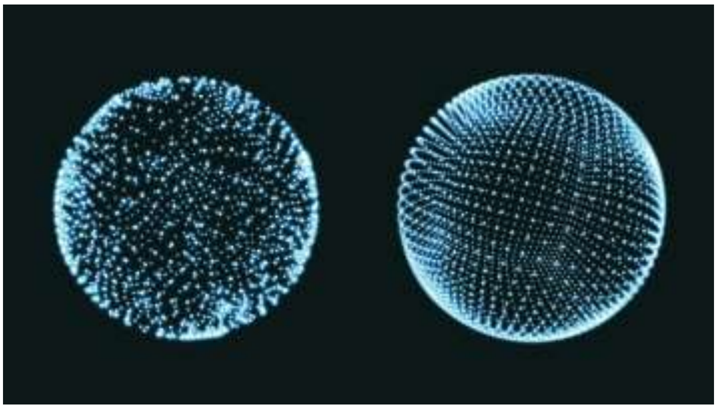

Figure 4: Particles switch between matter and antimatter[26]

CREATION OF UNIVERSE,MATTER, AND ANTIMATTER

16. We know from scientific calculations that the Big Bang, a catastrophic event that caused the universe to expand, occurred around 14 billion years ago. Thus, the 14 billion years represented by the magic number are a startlingly large number of strange things. The Big Bang's initial experimental proof was published in 1929, and it gained popularity throughout the 20th century. In reality, there is no reliable doubt that it occurred. The material that makes up our bodies is the well-known, common kind of matter; yet, antimatter, a unique form of matter, also exists. Ordinary matter and antimatter collide and obliterate one another in an incredibly powerful energy flash. Scientists discovered that a gram of antimatter will release energy equivalent to the devastating World War II (WWII) atomic bomb that destroyed Hiroshima in Japan[27] when it comes into contact with a gram of matter. While fusing matter and antimatter together can result in energy, the opposite is also true. The discovery of antimatter dates back to 1931. The popular science fiction book "Angels and Demons" by Dan Brown prominently displays the idea of antimatter and its dramatic function.

17. Actually, there is a problem and the Big Bang and antimatter are utterly disastrous. Combining these two truths creates a perplexing enigma since two things cannot both be true at the same time otherwise the narrative isn't complete. The solar system is

constituted of matter, as we well know. The subject of the other stars now emerges. Other stars in the Milky Way galaxy are now known to be formed of matter, according to scientists. Again, the solar wind is the name for the particles that the sun and other stars continuously emit. Atoms from the sun that travel out into interstellar space make up solar wind. As a result, matter and antimatter atoms would mix in the space between any antimatter stars[28]. Atoms of matter and antimatter should thus occasionally collide and smash together. And if that happened, a very particular type of gamma radiation would be produced, which are similar to extremely intense X-rays. Since no such gamma radiation has yet been discovered, it has been established that other stars are also composed of matter. Again, if gas clouds around the galaxies or the intergalactic gap between galaxies touch, we will know the results; however, there was no such evidence. Therefore, those demonstrated that antimatter does not exist in any galaxies or their surroundings.

18. The question is, where are we if the possibility that matter and antimatter galaxies exist does not save us? Actually, it is a very unusual notion that there was more matter than antimatter when Almighty God created the universe or when it first started. This appears to be the case, which is interesting and true. Evidence suggests that for every two billion antimatter particles there were two billion and one matter particles very early in the universe's existence, less than a second after it began. The one remaining matter particle combined with all the other remaining matter particles to form the matter that we can currently see around us after the two billion matter and antimatter particles completely destroyed each other. When matter and antimatter are destroyed, energy is released into the universe. We see it as a radio wave bath, or CMB for cosmic microwave background radiation. The ratio of matter to antimatter was discovered by measuring the CMB and counting all the protons in the cosmos. However, the universe was first a hive of energy. Both matter and antimatter can be created from energy. All that energy created both matter and antimatter in equal amounts as the cosmos expanded and cooled. The fact that the world we observe is constituted of nothing but stuff makes our observations mysterious[29].

19. The next question is whether it's conceivable for the matter and antimatter of the early cosmos to be somewhat out of balance. Strangely, scientists do have some theories. Scientists learned in the 1960s that the universe marginally prefers some subatomic matter particles to their antimatter counterparts. Quarks are the name for these constituents. Once more, the difference between quarks and antimatter quarks is insufficient to account for the universe. Researchers have an alternative theory. Our own sun is the largest nearby source of neutrinos, which are very low mass particles created in some types of nuclear decay. In order to determine whether the behavior of neutrinos and antimatter neutrinos differs, scientists are developing particle accelerators and detectors. The riddle might have an explanation if neutrinos and antimatter neutrinos behave differently[30]. Several facilities are being constructed to investigate this potential. But we must find an answer to this question if we are to comprehend why galaxies, stars, and even we humans tolerate[31]. Again, that is planned and managed by the Almighty God.

20. The public's imagination is captured by antimatter. 'Antimatter: What It Is and Why It's Important in Physics and Everyday Life', a notable book on the subject, was just released by Beatriz Gato-Rivera, a former European Organization for Nuclear Research (CERN) fellow in theoretical physics and current researcher at the Spanish National Research Council. Gato-Rivera begins by delving into the distinctions between atoms and anti-atoms as well as the annihilation of matter and antimatter, piqueing the reader's interest and leading them through a reasonably thorough introduction to particle physics. She focuses on a variety of antimatter science topics, starting with the distinctions between antimatter, dark matter, and dark energy as well as their various cosmic functions. This has to do with the universe's seeming acceleration of expansion. Gato-Rivera focuses in particular on candidates for dark matter and dark energy, searches for dark matter, and its connection to the universe's future. She also delineates the differences between primary and secondary antimatter and discusses how each plays a part in cosmology[32].

Figure 5: Astronomical image of dark matter left behind after a collision of galaxies[33]

21. Dark matter is the enigmatic substance that the universe is made of but that no one has ever seen. Because it does not appear to interact with the electromagnetic field—that is, it does not absorb, reflect, or emit electromagnetic radiation—dark matter is given the nickname "dark," making it challenging to detect. Numerous astrophysical findings, such as gravitational effects, cannot be described by the gravity theories that are now in use without the presence of dark matter, which is mass that cannot be seen. [34] The fact that dark matter and regular matter both exist but behave in different ways really caught us off guard. Particularly in the early universe, ordinary matter was ionized and experienced significant Thomson scattering interactions with radiation. Although dark matter does not directly interact with radiation, the CMB is still impacted by its gravitational potential (mostly on large scales) and impacts on the density and velocity of normal matter[35]. The existence of dark matter was first suggested by Swiss-American astronomer Fritz Zwicky, who discovered in 1933 that the mass of all the stars in the Coma cluster of galaxies provided only about 1% of the mass required to prevent the galaxies from escaping the cluster's gravitational pull[36]. Previously, it was known to us as the missing mass. For many years, the validity of this missing mass was in doubt, but in the 1970s, American astronomers Vera Rubin and W. Kent Ford observed a similar phenomena that proved its actuality. A normal galaxy's visible stars have just approximately 10% of the mass needed to keep them orbiting the galaxy's center[37]. Scientists have never observed more than 80% of the material that makes up the universe. The behavior of stars, planets, and galaxies simply wouldn't make sense without this so-called dark matter, which we can only guess exists[38]. Figure 5 above depicts a composite astronomical image of dark matter that results from galaxies colliding (Cluster Abell 520). White and orange starlight in the image indicates where the galaxies are located. Green-colored hot gas is the result of the accident. Gravitational lensing[39] data are used to estimate the blue color of the dark matter that was left behind.

HISTORY OF UNIVERSE AND CREATION OF AMAZING PARTICLES AND ANTI-PARTICLES

22. In the beginning of the universe, matter and antimatter should have been created in equal quantities by the Big Bang. But now, practically everything we see is formed of matter, from the tiniest planetary objects (the moon, planet, star, and galaxy) to the greatest living forms (viruses and bacteria) on Earth. Comparatively speaking, antimatter is scarce. The balance[40] must have tipped due to some event. Understanding what happened to the antimatter or the reason for the asymmetry between matter and antimatter is one of physics' most difficult problems. While antimatter particles have the same mass as their matter counterparts, they have the reverse of properties like electric charge. For instance, the positively charged positron is the opposite of the negatively charged electron. Always formed in pairs, matter and antimatter particles destroy one another when they come into contact, leaving behind only pure and enormous energy. The hot and dense universe was humming with particle-antiparticle pairs popping in and out of existence[41] within the first fractions of a second after the Big Bang.

23. It seems like the universe should be made entirely of residual energy if matter and antimatter are simultaneously formed and destroyed. Nevertheless, a very small fraction of matter—about one particle in a billion—has persisted. Surprisingly, this is what we observe right now. Recent advances in particle physics have demonstrated that matter and antimatter are subject to different sets of natural rules. Why are physicists so interested in learning? Prior to decaying, particles have been seen to spontaneously convert into their antiparticles millions of times each second. These oscillating particles may have decomposed into matter more frequently than they did into antimatter in the early cosmos due to some unidentified entity interfering in this process. [42] Think of a coin that is spinning on a table. It may land on its heads or its tails, but until it stops spinning and falls to one side, it cannot be said

to be on its heads or tails. There is a 50/50 probability that a coin will land on its head or its tail. Therefore, if enough coins are spun in the exact same manner, half should land on heads and the other half on tails. Similarly, in the early cosmos, half of the oscillating particles should have degenerated into matter and the other half into antimatter. However, the entire system would be upset if a unique form of marble rolled across a table of spinning coins and caused every coin it struck to land on its head. There would be a greater ratio of heads to tails. [43]The oscillating particles could have also been hampered by some unidentified mechanism, causing a small percentage of them to undergo material disintegration. By examining the tiny variations in the behavior of matter and antimatter particles produced in high-energy proton collisions at the Large Hadron Collider, physicists may be able to deduce what this process might be. Investigating this mismatch would make it easier for researchers to explain why our universe is so dense with matter[44].

24. Let's travel 13.8 billion years in the past to the Big Bang. Both the matter that makes up us and the so-called antimatter were formed in equal quantities by this event. Every particle is thought to have an antimatter partner that is almost similar to it but has the opposite charge. When a particle and its antiparticle collide, they vanish in a flash of light or a tremendous amount of energy. Arthur Schuster first proposed the existence of antimatter in 1896; Paul Dirac gave it a theoretical foundation in 1928; and Carl Anderson discovered positrons, anti-electrons, in 1932.

25. Natural radioactive processes, such the disintegration of potassium-40, produce the positrons. The same method is used to create antimatter in medical applications like PET scanners. Quarks and leptons are elementary particles that are the fundamental components of matter that make up atoms. There are six different types of quarks: top, bottom, up,down, charm and strange[45]. The electron, muon, tau, and three neutrinos are among the six known leptons. These twelve particles also exist as antimatter counterparts, which are depicted in figure 6 below and differ only in charge[46].

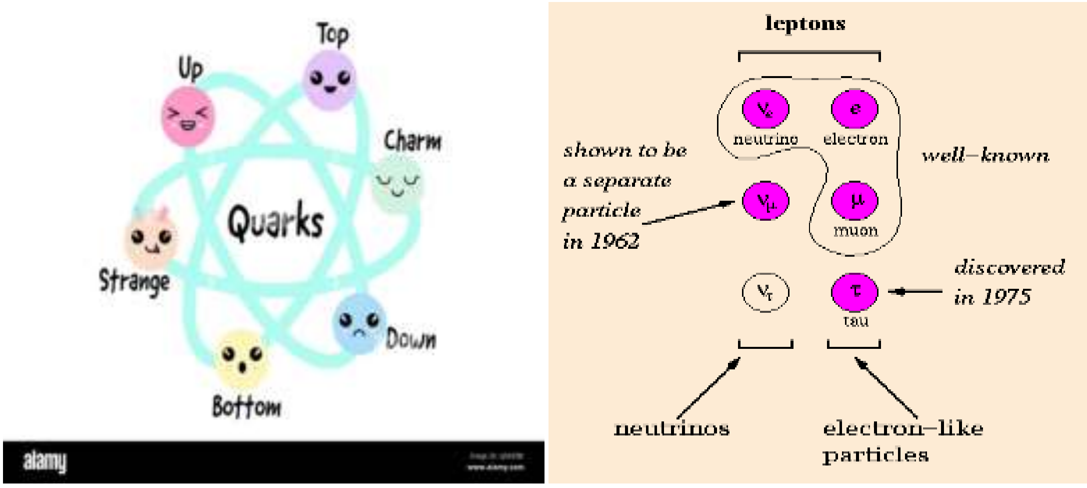

Figure 6: Image of six-quark[47] and structure of six-lepton[48]

As seen in figure 7 below, antimatter particles should, in theory, be exact mirror representations of their normal counterparts. However, research reveals that this isn't always the case. Consider the meson particle, which consists of one quark and one antiquark. The ability of neutral mesons to spontaneously transform into their anti-mesons and vice versa is an intriguing property. During this procedure, the quark can either transform into an anti-quark or an opposite quark. However, tests have demonstrated that this can occur more frequently in one way than the other, eventually producing more matter than antimatter. Only particles carrying odd and bottom quarks have been discovered to display these asymmetries among particles containing quarks, and these were extremely significant discoveries. When just three quarks were known to exist, the first detection of weird particle asymmetry in 1964 allowed theorists to anticipate the existence of six quarks. The mechanism that produced the six-quark picture[49] was finally confirmed by the identification of asymmetry in bottom particles in 2001. Both findings earned Nobel Prizes. A negative electric charge is carried by the weird quark and the bottom quark. The only positively charged quark that should, in principle, be able to create matter-antimatter asymmetric particles is charm. Theoretically, if it does, the effect should be negligible and challenging to notice[50]. Therefore, the universe's mystery has only deepened.

Figure 7: Image of neutrinos hint of matter and antimatter rift[51]

The unprecedented amount of charm particles produced directly in the LHC collisions, which I pioneered a decade ago, has now allowed the Large Hadron Collider beauty (LHCb) experiment to observe such an asymmetry in particles known as D-meson and which are composed of charm quarks, and it was for the first time. [52] The result indicates that the chance of this being a statistical fluctuation is about 50 in a billion. [53] If this asymmetry is not caused by the same mechanism that causes odd and bottom quark asymmetries, it opens the door to additional sources of matter and antimatter asymmetry, which can add to the total amount of asymmetry in the early universe. This is significant because the few known occurrences of asymmetry do not explain why the universe has so much matter. The charm discovery alone will not fill this void, but it is an important puzzle piece in comprehending the interactions of fundamental particles. [54]

27. Dr. Sakharov proposed a solution in 1967 for how matter and antimatter could have survived their mutual destruction agreement. One prerequisite is that natural laws may not be as symmetrical as physicists believe, as Einstein anticipated. Physics should work the same in a fully symmetrical universe if all the particles' electrical charges were switched from positive to negative or vice versa, as well as if the coordinates of everything were switched from left to right, as in a mirror. Violation of these constraints, known as charge and parity invariance, C and P for short, would result in matter and antimatter acting differently. Tsung-Dao Lee of Columbia University and Chen Ning Yang of the Institute for Advanced Study were awarded the Nobel Prize in Physics in 1957 for proposing something similar. They proposed that certain 'weak interactions' might violate the parity rule, and investigations by Columbia's Chien Shiung Wu, who was not awarded the prize, validated the notion. Nature is, in some ways, left-handed. [55]

28. In 1964, a team led by James Cronin and Val Fitch of Long Island's Brookhaven National Laboratory revealed that some particles known as kaons broke both the charge and parity criteria, exposing a telltale difference between matter and antimatter. These scientists were also awarded the Nobel Prize. In investigations at CERN and elsewhere, hints of a difference between matter and antimatter have since been discovered in the behavior of additional particles known as B mesons. According to Dr. Turner of the Kavli Foundation, CP violation is a huge concern in the big picture[56]. That is why we are on Earth or in the Universe! Both kaons and B mesons are comprised of quarks, the same particles that make up protons and neutrons and serve as the foundation of ordinary matter. However, there is not enough of a violation on the part of quarks to account for the universe's existence today by a factor of a billion. Neutrinos appear to be the most flimsy justification for our existence, as Dr Frederick Reines of the University of California stated, the tiny quantity of reality ever envisaged by a human being, and he discovered neutrinos. They first appeared on the global stage in 1930, when theorist Wolfgang Pauli proposed their existence to explain the minuscule amount of energy that is lost when radioactive decays produce an electron. The Italian physicist Enrico Fermi named them 'little neutral ones,' referring to their absence of an electrical charge. Dr. Reines found them emerging from a nuclear reactor in 1955 and was awarded the Nobel Prize[57] for his discovery.

29. The most abundant subatomic particles in the universe, known for their capacity to waft through ordinary matter like ghosts through a wall, are neutrinos, which come second to photons in electromagnetic radiation. Because they are so light, they have yet to be accurately weighed. But that is only the start of their ephemeral magic. In 1936, researchers discovered the muon, a heavier counterpart of the electron. This undermined their belief that they knew everything about elementary particles. Complicating the cosmic accounting, the muon also had its own related neutrinos, known as muon neutrinos, which were discovered in 1962. This resulted in yet another Nobel Prize. Martin Perl and his colleagues discovered tau, a much heavier variant of the electron, in studies at the Stanford Linear Accelerator Center in the 1970s. Dr. Perl and Dr. Reines [58] shared the Nobel Prize in 1995.

30. The Big Bang, it is widely assumed, and rightly so, had to be mostly symmetrical and demonstrate a smooth spherical uniformity in the pattern of particles, energy, and radiation spewed outward in all directions from the miraculous source. That would also apply to released particles vs their antiparticles, implying that the Big Bang should have produced equal amounts of matter and antimatter, with the expectation of complete and virtually instantaneous mutual annihilation. The Big Bang, it is widely assumed, and rightly so, had to be mostly symmetrical[59] and demonstrate a smooth spherical uniformity in the pattern of particles, energy, and radiation spewed outward in all directions from the miraculous source. That would also apply to released particles vs their antiparticles, implying that the Big Bang should have produced equal amounts of matter and antimatter, with the expectation of complete and virtually instantaneous mutual annihilation.

31. At the Big Bang 13.7 billion years ago, all that existed was an extremely hot soup of all sorts of particles. As the universe grew and cooled, ordinary matter particles such as neutrons, protons, and electrons began to join together to form atoms of the elements we see around the cosmos today, which are predominantly hydrogen and helium. Our theory of element-making in the first few minutes of cosmic genesis, called Big Bang nucleosynthesis[60]. It not only predicts that hydrogen and helium will be dominating, but it also gets them in the correct proportions that we see, allowing for changes that have occurred inside stars since. But there is a catch to this achievement. The amount of each element that forms, it turns out, is highly sensitive to the amount of baryonic matter available in the universe. Essentially, BBN predicts the correct element ratios for the universe today only if the original amount of baryonic matter was less than 10% of the crucial amount of matter required to cease cosmic expansion. Scientists are quite certain that most dark matter isn't formed of baryons because dark matter accounts for significantly more than ten percent of the crucial value.

32. If dark matter is not composed of conventional matter, which is baryonic, it must be composed of exotic matter, which is non-baryonic. In this sense, theorists employ the term exotic as a catch-all: it may refer to something unusual and novel, but it does not have to. Some non-baryonic dark matter could be composed of a particle known for many years: the neutrino. Every second, billions of neutrinos from space (many from the sun) pass through our bodies and then cleanly through the entire Earth. Despite their aloofness, they are one of the most numerous particles in the universe, and recent research has revealed that, contrary to popular assumption, they almost probably have a small amount of mass[61]. Scientists now believe that Weakly Interacting Massive Particles (WIMPS) account for the vast majority of dark matter in the cosmos. There is a slight imbalance in the behavior of conventional exotic matter and exotic antimatter, which is thought to explain the current matter/antimatter imbalance[62].

33. Some scientists, like Albert Einstein, fought hard against the Big Bang theory, which states that the universe burst into existence a finite time ago, until scientific evidence proved too overwhelming to refute[63]. The universe included protons, antiprotons, neutrons, antineutrons, electrons, and positrons a hundred thousandth of a second after the big bang. However, after the synthesis of protons and neutrons, the next great change was not particle fusion, but particle destruction. There was a lot of this radiation after matter and antimatter annihilated since that's where all the energy from those annihilations went. Radiation had more than a billion times the energy of matter in the 10-second-old cosmos[64]. We simply do our best to comprehend it. According to University of Chicago DUNE co-spokesperson Ed Blucher, "it makes me very excited that there will be something interesting to study in the next generation of experiments that are coming." [65] Nature unravels as it wills; we have no influence over it. That is yet another desire, want, and secret of Almighty God, who created and controls everything in the universe, whether we perceive it or not.

DARK MATTER AND FUTURE RADIO

34. Dark matter is an invisible substance that is believed to be five times more prevalent in the cosmos than ordinary matter. Each second, billions of dark matter particles pass across the Earth, according to the theory. Researchers hope to detect dark matter waves using the dark matter radio. Large underground detectors are used in direct detection experiments for dark matter particles. The scientists are hoping to see signs from dark matter particles colliding with the detector material. However, this works only if the dark matter particles are heavy enough to deposit visible energy in the impact. According to Peter Graham, if dark matter particles were exceedingly light, we could be able to detect them as waves rather than particles. Our device will direct the search in that direction. He works as a theoretical physicist at Stanford University's Kavli Institute for Particle Astrophysics and Cosmology. The dark matter radio employs a strange quantum physics notion known as wave-particle duality: Every particle can behave like a wave[66] . When we discuss the indomitable particle or the photon, it is the massless fundamental particle that conveys the electromagnetic force. Streams of them combine to form electromagnetic radiation, or light, which we commonly refer to as waves in general and radio waves in particular.

35. The dark matter radio will look for dark matter waves linked to two specific dark matter candidates. It might detect hidden photons, which are hypothetical pals of photons with a minuscule mass, or it could detect axions, which scientists believe can be made from light and transformed back into it in the presence of a magnetic field. According to Saptarshi Chaudhuri, the quest for hidden photons will be completely uncharted ground. He is a graduate student at Stanford working on the axions project. He also stated that, for axions, the dark matter radio will fill gaps in previous experiments' searches[67]. A typical radio, for example, intercepts radio waves via an antenna and transforms them to sound. A listener selects a station by altering an electric circuit that allows electricity to oscillate at a specific resonance frequency. If the resonant frequency of the circuit matches the frequency of the station, the radio is tuned in and the listener can hear the broadcast. The dark matter radio operates in the same manner. [68] An electric circuit with a changeable resonance frequency is at its heart. The circuit would resonate if the gadget was adjusted to a frequency that corresponded to the frequency of a dark matter particle wave.

36. Scientists could determine the mass of the dark matter particle by measuring the frequency of the resonance. The objective is to perform a frequency sweep by gradually going over the various frequencies, as if tuning a radio from one end of the dial to the other. The dark matter radio's final design will look for particles with masses ranging from trillionths to millionths of an electronvolt. We know that one electronvolt is one billionth of a proton's mass. This is extremely difficult because the frequency ranges from kilohertz to gigahertz. The dark matter radio has the advantage of not needing to be insulated from cosmic rays. Direct detection searches for dark matter particles must be conducted deep down to avoid particles falling from space, however the dark matter radio can be conducted in any basement or underground. The dark matter disc jockeys are only getting started, and they intend to perform their dark matter searches over the next few years. [69] We are anticipating the outcome.

FUTURE USE OF ANTIMATTER

37. The antimatter is the polar opposite of matter. It's mysteriously elusive, and when it comes into contact with conventional matter, the two annihilate. But there's more to the amazing things, including a few noteworthy facts, which will be presented in sequences in the following pages. [70] While antimatter bombs and antimatter-powered spaceships are unlikely, there are numerous things regarding antimatter that will pique our interest today and in the future[71]. Antimatter propulsion is the ultimate propulsion mechanism based on the emission of reaction mass, and dream spacecraft powered by antimatter are possible in the future[72]. Let's talk about the future applications and inventions of antimatter, which is both mysterious and thought-provoking.

a. Antimatter obliterated all matter in the universe immediately after the Big Bang[73]. According to theory, the Big Bang should have produced equal amounts of matter and antimatter. When matter and antimatter collide, they annihilate, leaving a massive amount of energy behind. We simply cannot exist if it is true in principle. Whatever the case may be, we still exist. However, physicists/scientists believed that this was due to the fact that at the conclusion of the Big Bang, there was one additional matter particle for every billion matter and antimatter pairs. [74] Physicists are working hard to explain this asymmetry, which remains a mystery.

b. Antimatter is always getting closer to us, but nothing happens. Small amounts of antimatter, which are energetic particles from space, are constantly raining down on the globe in the form of cosmic rays. These antimatter particles enter our atmosphere at rates ranging from fewer than one per square meter to more than one hundred per square meter. Antimatter generation above thunderstorms[75] has also been observed by scientists. It's fascinating that bananas make antimatter. We know that every 75 minutes, one positron is released, which is the antimatter equal of an electron. This happens because bananas contain a trace of potassium-40, a naturally occurring isotope of potassium. When potassium-40 decays, it may occasionally spit forth a positron. As a result, our bodies contain potassium-40, which means we emit positrons. Because antimatter annihilates instantly when it comes into touch with matter, these antimatter particles have a very brief lifetime.

c. Humans have only produced a trace quantity of antimatter. According to scientists, the annihilation of antimatter and matter has the potential to release a massive amount of energy. A gram of antimatter might cause an explosion the size of a nuclear[76] bomb. However, humanity have only created a trace amount of antimatter. The total amount of anti-protons produced by Fermilab's Tevatron particle accelerator is only 15 nanograms. CERN produces roughly 1 nanogram of these. To date[77], approximately 2 nanograms of positrons have been created at DESY in Germany. The energy produced by annihilating all antimatter ever created by humanity would not even be enough to boil a cup of tea. The issue is with the efficiency and expense of antimatter generation and storage. Making one gram of antimatter would need around 25 million billion kilowatt-hours of energy, which might cost more than a million billion dollars. [78]

d. It is conceivable to create/invent an antimatter trap. We need to keep antimatter from annihilating with matter in order to study it. Scientists have devised methods to accomplish this. Penning Traps are devices that can hold charged antimatter particles such as positrons and antiprotons. Such a gadget [79] can trap electrically charged antimatter. This is analogous to micro accelerators. Particles spiral around inside the trap as magnetic and electric forces prohibit them from colliding with the trap's walls. However, Penning traps will not function on neutral particles such as anti-hydrogen. These particles cannot be contained by electric fields since they have no charge. They are instead held in Ioffe Traps, which work by producing a zone of space where the magnetic field expands in all directions[80]. Like a marble rolling around the bottom of a bowl, the particle becomes caught in the area of the weakest magnetic field. The Earth's magnetic field can also serve as an antimatter trap[81]. Van Allen radiation belts, which round the Earth, have been found to contain antiprotons.

e. Antimatter could collapse. Antimatter and matter particles have the same mass but differ in attributes such as electric charge and spin. The Standard Model predicts that gravity should have the same impact on matter and antimatter; however, this has yet to be observed. Experiments like as AEGIS, ALPHA, and others are working hard to find out. Observing gravity's influence on antimatter is not as simple as watching an apple fall from a tree. These investigations must either trap antimatter or slow it down by cooling it to temperatures just above absolute zero. Because gravity is the weakest of the fundamental forces, physicists must conduct these experiments with neutral antimatter particles to avoid interference from the more powerful electrical force.

f. Antimatter is being investigated in particle decelerators. Particle accelerators are well-known; nevertheless, particle decelerators are also available. CERN is home to the Antiproton Decelerator[82], a storage ring capable of capturing and slowing antiprotons in order to research their properties and behavior. Particles in circular particle accelerators like the Large Hadron Collider get a boost of energy every time they complete a rotation. Decelerators work in reverse, giving particles a kick backward to slow them down instead of an energy boost[83].

g. Neutrinos may be antiparticles to themselves. Because a matter particle and its antimatter companion have opposing charges, they are easily distinguished. Neutrinos have no charge since they are nearly massless particles that rarely interact with matter. Scientists believe they are Majorana particles, a hypothetical type of particles that are antiparticles to themselves. Majorana Demonstrator[84] and EXO-200[85] projects seek to determine whether neutrinos are Majorana particles by looking for a behavior known as neutrinoless double-beta decay. Some radioactive nuclei decay at the same time, releasing two electrons and two neutrinos. If neutrinos were their own antiparticles, they would annihilate each other in the aftermath of the double decay, leaving just electrons for scientists to study. The discovery of Majorana neutrinos could help explain why there is antimatter-matter asymmetry. Majorana neutrinos, according to physicists, can be either heavy or light. The light ones are still around now, while the hefty ones would have existed just after the great bang. These massive Majorana neutrinos would have decayed asymmetrically, resulting in the minuscule matter surplus that allowed for the existence of our universe.

h. Antimatter will be widely used in medicine in the future. PET employs positrons to generate high-resolution pictures of the body. [86] Positron-emitting radioactive isotopes (such as those found in bananas) are connected to chemical molecules utilised by the body naturally, such as glucose. These are put into the bloodstream and naturally degrade, generating positrons that collide with electrons in the body and annihilate them. The annihilations generate gamma rays, which are employed to create images. CERN's ACE project scientists investigated antimatter as a potential possibility for cancer therapy. [87] Physicians have previously established that they can target cancers with particle beams that release energy only after passing safely through healthy tissue. Using antiprotons provides an additional burst of energy. Although the approach was shown to be efficient in hamster cells, researchers have yet to test it on human cells.

i. The antimatter that should have stopped us from existing could still be out there somewhere. Scientists are seeking for antimatter left behind from the big bang as one method to tackle the antimatter-matter asymmetry problem. The Alpha Magnetic Spectrometer (AMS) is a particle detector aboard the International Space Station that searches for these particles[88]. Magnetic fields in the AMS bend the course of cosmic particles, separating matter from antimatter. As particles move through, its detectors evaluate and identify them. Cosmic ray collisions commonly produce positrons and antiprotons, but the likelihood of producing an anti-helium atom is exceedingly rare due to the enormous amount of energy required[89]. This means that even observing a single anti-helium nucleus would be significant proof for the existence of a huge amount of antimatter somewhere in the cosmos.

j. People are researching and attempting to design and build spacecraft that will use antimatter as fuel. Antimatter, as we know, can generate vast amounts of power or energy, making it a common fuel for futuristic vehicles depicted in science fiction. Theoretically, antimatter rocket propulsion is a possibility. The main constraint is amassing enough antimatter to make it possible. There is currently no technology that can mass-produce or gather antimatter in sufficient quantities for this application. However, a small number of researchers have done propulsion and storage simulation experiments. These people include Marc Weber and his associates at Washington State University, Ronan Keane and Wei-Ming Zhang, who completed their research at Western Reserve Academy and Kent State University, respectively. One day, perhaps as a result of our research, we will discover a technique to produce or gather vast quantities of antimatter, and at that time, interstellar travel powered by antimatter will become a reality. Let's await that time.]

k. Scientists are confident that antimatter exists in all atoms. The proton, neutron, and electron were most likely the first three subatomic particles we knew about. These particles are the building blocks of the atoms that make up our bodies and the world we see around us. Only the electron is elementary, which implies it is not composed of any smaller components. Protons and neutrons, on the other hand, are made up of basic particles known as quarks and gluons[90]. Protons and neutrons are typically described as having three quarks. But the reality is far more complicated. Quarks, antiquarks, and gluons abound in protons and neutrons. Particles and antiparticles constantly clash and destroy one another inside of a proton or a neutron. In this tidal wave of arising and vanishing particles, protons and neutrons are said to consist of merely three quarks. Those three quarks still don't have an antimatter equivalent, according to Beatriz Gato-Rivera, a researcher at the Spanish National Research Council and author of an antimatter book. Antiprotons, which are the antimatter

International Journal of Current Science Research and Review
ISSN: 2581-8341
Volume 06 Issue 06 June 2023
DOI: 10.47191/ijcsrr/V6-i6-52, Impact Factor: 6.789
IJCSRR @ 2023
www.ijcsrr.org

equivalents of protons, are made up of three unpaired anti-quarks. Antimatter is therefore present all around us, both inside the atoms that make up our body and in the atoms of everything else on Earth and possibly even in the entire cosmos.

l. Antimatter was first predicted mathematically and theoretically.Paul Dirac, a British scientist, was confronted with a conundrum in 1928. He had developed a hypothesis that integrated Einstein's special relativity and quantum mechanics to describe the behavior of electrons. But in order for his mathematical equations to function, he needed a particle that didn't exist at the time. The new particle has to be the same mass as an electron but charged in the opposite direction. He ultimately hypothesized the existence of such a particle, which he named an anti-electron, [91] three years later. At the California Institute of Technology in the same year, American physicist Carl Anderson was photographing odd particle trails created as cosmic rays traveled through a particle detector called a cloud chamber. In 1932, Anderson established that the tracks originated from the particles released when cosmic rays struck Earth's atmosphere and that Dirac had predicted. The particles were called positrons by Anderson[92]. It was interestingly the first antimatter observation that was verified. We were further surprised to see that imbalanced mathematical equations also produced predictions for additional particles.
The masses and stability of atoms could not be described solely by their protons and electrons in the early twentieth century. Ernest Rutherford argued that another neutral particle, the neutron, must be adding to their weight. Scientists required an explanation in 1930 for why nuclei that emitted energy in the form of beta particles during radioactive decay did not rebound straight back, but rather at an angle. Wolfgang Pauli postulated that the decay must emit another unseen particle, the neutrino, at the same moment. Other particles, like as axions, supersymmetric particles, and dark matter particles[93], are currently being sought by scientists. That, in fact, might explain many long-standing mysteries in particle physics and cosmology. We are eagerly anticipating those inventions.

m. In the future, scientists will create/invent hybrid atoms composed in part of antimatter. Scientists can create a metastable hybrid atom termed anti-protonic helium by slowing antiprotons in a particle decelerator and then merging them with cryogenic helium. [94] A component particle in hybrid or exotic atoms has been switched out with another particle with the same charge. In some situations, the new particle is an antimatter particle. The electron of a helium atom is replaced with an antiproton in anti-protonic helium. Similarly, muonium has an antimuon, which has an electron and positronium, which has an electron and a positron. On an infinitesimal scale, exotic atoms are utilized to examine interactions between matter and antimatter. Researchers are able to examine events that might not be studied otherwise thanks to the short-scale interactions between the particles and antiparticles within atoms. These short-scale interactions are a crucial tool in the quest for novel physics, according to Anna Soter, a particle physicist at ETH Zurich. In order to look for evidence of a unique fifth force between the antiproton and the electron, scientists are examining strange atoms. Exotic atoms are another tool used by scientists to take extremely accurate measurements of particle characteristics. This enables them to test the Standard Model's symmetries, such as the assertion that particles and their antiparticles ought to have the same mass and charge but an obverse sign. According to Anna Soter, the largest exotic atom containing antimatter that researchers have been able to analyze using laser spectroscopy[95] is the metastable anti-protonic helium atom. Again, the research of muonium and positronium is fascinating. In the absence of strong interactions, these atoms are made up exclusively of elementary particles. Scientists may now produce anti-atoms in addition to hybrid particles. For instance, CERN researchers are creating anti-hydrogen[96] by fusing antiprotons and positrons.

n. Today, scientists have discovered more antimatter in our galaxy than they can explain.The European Space Agency's INTEGRAL mission discovered a gamma ray signal in the core of the Milky Way in the 1970s. The brightness and spread of this signal showed that the equivalent of 9 trillion kilos of positrons (that's 1043 positrons) were being annihilated each second within our galaxy's core/center, which was significantly more than astronomers predicted. It's unclear where all of these positrons come from. One possibility is the super massive black hole at the heart of the galaxy. Other enormous black holes were discovered nearby, as well as swiftly spinning neutron stars known as pulsars and those annihilations between dark matter particles. Several studies are being conducted in order to pinpoint the source of gamma-rays at the center of our galaxy. For example, the Compton Spectrometer and Imager (COSI) is a gamma-ray telescope that will study our galaxy's center to search for the source of these positrons. [97] Other initiatives, such as the projected All-sky Medium Energy Gamma-ray Observatory (AMEGO) [98], aim to shed light on this issue as well. Scientists recently discovered a second surplus of positrons, this time at a far higher energy level. In 2008, the PAMELA cosmic-ray detector on board a Russian satellite showed that more antimatter particles were going through Earth than scientists had projected. AMS-02, an experiment that was put on the International Space Station in 2011 and has supported the PAMELA collaboration's findings, is one example of an experiment. What is the source of these additional positrons? There have been various hypotheses presented[99]. The most likely candidates, in Tim Linden's opinion, are pulsars, [100] an astronomer at Stockholm University. To determine how many positrons pulsars emit, scientists have been analyzing the gamma rays they emit.

STILL MANY IRREGULARITY,MYSTERY AND QUESTION REMAIN UNSOLVED

38. Most scientists believed the universe began roughly 14.5 billion years ago in a cataclysmic event known as the Big Bang. There is no rational doubt that it occurred. In addition to the conventional form of matter that we are all made of, there is an exotic form known as antimatter. It has the feature that when it comes into contact with conventional matter, the two overpower each other in an amazingly huge flash of energy. Indeed, when a gram of antimatter collides with a gram of matter, it emits roughly the same amount of energy as the 1945 atomic bomb that devastated Hiroshima. While merging matter and antimatter can result in energy, the opposite is also true. Energy may generate both matter and antimatter in equal quantities. Antimatter was discovered in 1931, and the case has only become stronger since then. [101] The existence of antimatter is widely recognized.

39. Scientists discovered in the 1960s that the universe marginally favors certain subatomic matter particles over their antimatter counterparts. These particles are known as quarks. However, the difference between quarks and antiquarks is insufficient to explain the universe, therefore scientists have devised another theory. Neutrinos are very low mass particles created by some forms of radioactive decay, and our own sun is the largest nearby source of neutrinos. Particle accelerators and detectors are being built by researchers to analyze the behavior of neutrinos and antimatter neutrinos to see if they vary. If neutrinos and antimatter neutrinos behave differently, the enigma may be solved. It is possible that our universe formed by Leptogenesis [102], which is the formation of low-mass particles. [103]

40. We are left with the bizarre idea that when the cosmos first began, there was more matter than antimatter. It appears that less than a second after the beginning of the universe's birth, there were two billion matter particles for every two billion antimatter particles. The two billion matter and antimatter particles annihilated each other, leaving only one matter particle to combine with the remaining matter particles to form the stuff we see around us. The energy released when matter and antimatter collide is all around us. The CMB[104] is a bath of radio waves that we observe. The matter-antimatter ratio was determined by measuring the CMB and counting the protons in the cosmos.

41. The electromagnetic radio wave created by an antimatter dipole antenna would have the opposite polarity of the field because positive charges would be transferred rather than negative charges. However, the receiving antenna would continue to detect the electromagnetic wave, and the negative charge in the regular matter antenna would respond to it. The fact that the wave began with a different polarity doesn't really matter because the relative phase also depends on the distance between the antennas, and moving the antenna a half wavelength away changes the phase 180 degrees. The radio operates by sending and receiving photon streams. The anti-radio operates by emitting and receiving anti-photon streams. However, anti-photons are identical to photons. So not only can the anti-radio communicate with the ordinary radio, but it also does not require modification to function. In general, distinguishing matter from antimatter without annihilating it is extremely difficult. Almost any chemical might exist in both antimatter and matter. However, as previously stated, the polarity of light for antimatter would be reversed. However, a radio could not detect this. Many scientists assumed that the universe had equal amounts of matter and antimatter prior to the discovery of gamma ray astronomy. There is no way to distinguish if light or radio waves are produced by matter or antimatter. Even intergalactic space isn't a perfect vacuum, so if there was a lot of antimatter there, we would observe it. It is incredibly enigmatic.

42. Is the cosmos not quite what we think it is? In reality, we can only see a small portion of it. Scientists and physicists have been trying to figure out what this elusive, undiscovered part of our cosmos is. Is dark matter a significant component? What is it made of and how can we find it? Scientists have discovered that dark matter is merely a minor portion of the larger tale, and that this is only the beginning. There is also a component of the universe known as dark energy. According to scientists, dark matter accounts for 25% of the 'unknown material' in the cosmos, while dark energy accounts for the remaining 70%.[105]

43. There could be an alien civilization out there, beyond the unfathomable expanse of space. They might resemble us quite a little. They might have received photographs, ice cream, and peer-to-peer networking.[106] What's more intriguing is that, like us, they communicate heavily using radio waves. Actually, they are so far away that we are unaware that they even exist. We won't be able to spot them using their equipment that blocks out sunlight. The aliens may not be doing anything to either hide their presence or publicize their position[107] because they may have been using modern technology for a long enough period of time for any transmissions they may have made to reach us. At the time that we are seeing them, their technology might be at this stage. All near-future technology[108] is therefore set back by a period of time that is equivalent to the number of light years between Earth and their planet.

CONCLUSION

44. The evidence for the Big Bang and antimatter's existence is just overwhelming, yet there is a dilemma. These two facts when put together create a perplexing enigma. They cannot both be true at the same time, or the story is at the very least unfinished. The issue is this. The cosmos was a hive of energy at the beginning of the universe. Both matter and antimatter can be created from energy. All that energy should have produced an equal amount of matter and antimatter when the cosmos cooled and expanded. However, when we take a look around, we come upon a perplexing finding. The universe we see today is entirely composed of matter. Once more, the cosmos we see is entirely composed of stuff. The cosmos was a hive of energy at the beginning of the universe. Because energy can be converted into matter and antimatter, as the cosmos cooled, the energy should have transformed into equal parts matter and antimatter. We've seen it in Dan Brown's bestselling novel 'Angels and Demons,' where it played an important and realistic role. There is no difficulty if matter and antimatter do not come into contact. In theory, the Moon may be antimatter. We all know this isn't true. For example, because Neil Armstrong and the complete lunar Lander were composed of stuff. If the Moon were comprised of antimatter, there would have been a massive explosion when the spacecraft touched down on its surface. But it did not occur, proving that the moon is made of matter. The same conclusion about our cosmic vicinity is drawn from studying other planetary objects.

45. Matter makes up the solar system. There is no doubt that matter also makes up the other stars in the Milky Way galaxy. Particles, known as the solar wind in our solar system, are continuously emitted by stars like our Sun. In essence, it is made up of Sun atoms that have traveled into interstellar space. Atoms of matter and antimatter would occasionally collide and disintegrate. A very specialized type of gamma radiation would be produced as a result, similar to extremely energetic X-rays. We are confident that other stars are also composed of matter because no such gamma radiation has been found. The presence of antimatter galaxies and the intergalactic space between galaxies is also ruled out by the same reasoning. As we know, no known reaction can release more energy than antimatter and matter annihilation. So, antimatter propulsion is the ultimate propulsion technology based on the emission of reaction mass, and dream spacecraft can be powered by antimatter. However, the synthesis of antimatter for human use, the uncertainty of the formation of the cosmos, and understanding of the special substances and energy mentioned in this work remain mysteries. One day, scientists and physicists will discover more knowledge and develop new concepts and explanations that will help us better grasp the cosmos and all of its strange creations. The Creator, often known as God, has knowledge of and control over all the solutions to the universe's mysteries and uncertainties. The ultimate truth is that there is only one God, or Allah, who created and governs everything in the universe, both visible and invisible.

REFERENCES

[1] https://www.nasa.gov/mission_pages/hubble/main/index.html, accessed on 13 May 2023
[2] https://science.nasa.gov/astrophysics/focus-areas/what-is-dark-energy, accessed on 11 May 2023

International Journal of Current Science Research and Review
ISSN: 2581-8341
Volume 06 Issue 06 June 2023
DOI: 10.47191/ijcsrr/V6-i6-52, Impact Factor: 6.789
IJCSRR @ 2023
www.ijcsrr.org

[3] http://www.scientificamerican.com/article/follow-up-what-is-the-zer, accessed on 11 May 2023
[4] https://www.radiologyinfo.org/en/info/pet, accessed on 11 May 2023
[5] https://www.mayoclinic.org/tests-procedures/pet-scan/about/pac-20385078, accessed on 12 May 2023
[6] https://www.daviddarling.info/encyclopedia/E/exotic_matter.html, accessed on 12 May 2023
[7] https://www.sciencefocus.com/space/what-is-exotic-matter, accessed on 13 May 2023
[8] https://www.merriam-webster.com/dictionary/nonbaryonic, accessed on 13 May 2023
[9] https://www.sun.org/encyclopedia/degeneracy, accessed on 14 May 2023
[10] Goldberg Lesley, Star Trek' Pike and Spock Series Set at CBS, The Hollywood Reporter, Archived, 15 May 2020
[11] https://byjus.com/jee/pauli-exclusion-principle, accessed on 12 May 2023
[12] https://science.nasa.gov/astrophysics/focus-areas/what-is-dark-energy, accessed on 13 May 2023
[13]https://www.google.com/search?q=images+of+antimatter&oq, accessed on 09 May 2023
[14] https://www.scirp.org/journal/paperinformation.aspx?paperid=106493, accessed on 12 May 2023
[15] Ryden, B., Introduction to Cosmology, 2nd Edition, Cambridge University Press, Cambridge, 2017
[16]https://sites.imsa.edu/hadron/2022/02/02/the-matters-and-what-they-teach-us-about-the-universe, accessed on 13 May 2023
[17] https://www.quora.com/What-is-the-difference-between-mirror-matter-and-antimatter, accessed on 12 May 2023
[18] https://www.wonderopolis.org/wonder/what-is-dark-matter, accessed on 13 May 2023
[19] https://www.energy.gov/science/doe-explainsdark-matter, accessed on 13 May 2023
[20] https://cdn.mos.cms.futurecdn.net/83NYdQHW3WM2CsUryW2wP7-1200-80.jpg, accessed on 12 May 2023
[21] Morris, Christopher G., Academic Press dictionary of science and technology, Academic Press. San Diego, 1992
[22]https://www.wtamu.edu/~cbaird/sq/2014/07/25/is-there-any-difference-between-antimatter-dark-matter-dark-energy-and-degenerate-matter, accessed on 11 May 2023
[23] G. A. Benford, D. L. Book, W. A. Newcomb, The Tachyonic Antitelephone, Physical Review D. 2, 1970
[24] https://en.wikipedia.org/wiki/Exotic_matter, accessed on 11 May 2023
[25] G. A. Benford, D. L. Book, and W. A. Newcomb, The Tachyonic Antitelephone, Physical Review, 1970
[26] https://interestingengineering.com/science/physicists-observe-particles-switch-between-matter-and-antimatter, accessed on 13 May 2023
[27] https://bigthink.com/hard-science/matter-antimatter-half-universe-missing, accessed on 14 May 2023
[28] Pebbles P.J.E., Principles of Physical Cosmology. Princeton University Press, Princeton, 1993
[29]https://www.jstor.org/stable/44481406, accessed on 09 May 2023
[30] https://www.sciencedirect.com/topics/earth-and-planetary-sciences/hypothetical-particle, accessed on 9 May 2023
[31]https://bigthink.com/hard-science/matter-antimatter-half-universe-missing, accessed on 9 May 2023
[32]https://cerncourier.com/a/exploding-myths-about-antimatter, accessed on 09 May 2023
[33] https://www.nasa.gov/mission_pages/hubble/science/dark-matter-core.html, accessed on 11 May 2023
[34] Trimble, V., Existence and nature of dark matter in the universe, Annual Review of Astronomy and Astrophysics, Dec 1987
[35] NASA Science Universe – Dark Energy, Dark Matter, NASA Science, accessed on 11 May 2023
[36] Ferris Timothy, Dark matter, Hidden cosmos, National Geographic Magazine, Jan 2015
[37] https://www.britannica.com/science/dark-matter, accessed on 09 May 2023
[38] https://www.space.com/20930-dark-matter.html, accessed on 09 May 2023
[39] Public Domain Image, source: NASA, ESA, CFHT, CXO, M.J. Jee, University of California, Davis, and A. Mahdavi, San Francisco State University, USA.
[40] Kaku M., First Second of the Big Bang, How the Universe Works, Season 3, Episode 4, Discovery Science, 2014
[41] Corda C., Interferometric Detection of Gravitational Waves: The Definitive Test for General Relativity, International Journal of Modern Physics, 2009
[42] Shiffman, M., Large Extra Dimensions: Becoming Acquainted with an Alternative Paradigm, World Scientific, Singapore, 2009
[43] Alpher R. A., Herman R., and Gamow G., Evolution of the Universe, Nature, 1984
[44] https://home.cern/science/physics/matter-antimatter-asymmetry-problem, accessed on 11 May 2023
[45] Randall L. and Sundrum R., Large Mass Hierarchy from a Small Extra Dimension, Physical Review Letters, 1999

International Journal of Current Science Research and Review
ISSN: 2581-8341
Volume 06 Issue 06 June 2023
DOI: 10.47191/ijcsrr/V6-i6-52, Impact Factor: 6.789
IJCSRR @ 2023
www.ijcsrr.org

[46] Riordan, Michael, Zajc, William A., The First Few Microseconds, Scientific American, Vol. 294, no. 5, May 2006
[47] https://www.google.com/search?q=six-quark+picture&oq, accessed on 11 May 2023
[48] https://www.quora.com/What-are-Leptons-made-of, accessed on 11 May 2023
[49] https://www.riken.jp/en/news_pubs/research_news/rr/20211210_1/index.html, accessed on 16 May 2023
[50] Ta-Pei-Cheng, A College Course on Relativity and Cosmology, Oxford University Press, Oxford, 2015
[51] https://www.quantamagazine.org/do-neutrinos-explain-matter-antimatter-asymmetry, accessed on 12 May 2023
[52] https://home.cern/science/experiments/lhcb, accessed on 11 May 2023
[53] Binney, J., Astrophysics: A Very Short Introduction, Oxford University Press, Oxford, 2016
[54]https://www.scientificamerican.com/article/why-is-there-more-matter-than-antimatter, accessed on 11 May 2023
[55] Ta Pei Cheng, A College Course on Relativity and Cosmology, Oxford University Press, Oxford, 2015
[56] https://www.symmetrymagazine.org/article/october-2005/cp-violation, accessed on 12 May 2023
[57] https://www.nobelprize.org/prizes/physics/1995/reines/biographical, accessed on 12 May 2023
[58]https://www.nytimes.com/2020/04/15/science/physics-neutrino-antimatter-ichikawa-t2k.html, accessed on12 May 2023
[59]https://arxiv.org/ftp/physics/papers/0007/0007058.pdf, accessed on 11 May 2023
[60] Burles Scott, Kenneth M, Nollett, and Michael S. Turner, What Is The BBN Prediction for the Baryon Density and How Reliable Is It?, Phys. Rev, 2001
[61] IbId
[62] https://academic.oup.com/book/645/chapter-abstract/135343734?redirectedFrom=fulltext, accessed 19 May 2023
[63] https://evolutionnews.org/2021/12/stephen-meyer-asks-how-did-the-universe-begin, accessed on 15 May 2023
[64] https://www.wondriumdaily.com/annihilation-and-creation-the-story-of-matter-and-antimatter, accessed on 15 May 2023
[65] https://news.fnal.gov/2021/04/gina-rameika-elected-dune-co-spokesperson, accessed on 15 May 2023
[66] Pebbles P.J.E., Principles of Physical Cosmology. Princeton University Press, Princeton, 1993
[6767] https://kipac.stanford.edu/news/radio-dark-matter, accessed on 16 May 2023
[68] https://soundcloud.com/darkmatterradio, accessed on 16 May 2023
[69] https://www.symmetrymagazine.org/article/a-radio-for-dark-matter, accessed on 13 May 2023
[70]https://www.symmetrymagazine.org/article/four-more-things-you-might-not-know-about-antimatter, accessed on 11 May 2023
[71]https://www.symmetrymagazine.org/article/april-2015/ten-things-you-might-not-know-about-antimatter, accessed on 10 May 2023
[72] https://www.sciencedirect.com/topics/earth-and-planetary-sciences/antimatter, accessed on 11 May 2023
[73] Singh, Simon, Big Bang: The Origin of the Universe, New York, Harper Perennial, 2005
[74] https://home.cern/science/physics/matter-antimatter-asymmetry-problem, accessed 10 May 2023
[75] https://www.google.com/search?q=cosmic+rays%2C+energetic+particles+from+space&ei, accessed 11 May 2023
[76] Cold Atom Laboratory Mission, Jet Propulsion Laboratory, NASA, 2017
[77] https://www.fnal.gov/pub/tevatron/tevatron-accelerator.html, accessed on 13 May 2023
[78]https://www.jstor.org/stable/44481406, accessed on 13 May 2023
[79] https://www.google.com/search?q=penning+trap+antimatter&ei, accessed on 16 May 2023
[80] https://alpha.web.cern.ch/science/ioffe-pritchard-trap, accessed on 16 May 2023
[81]http://cui.unige.ch/isi/sscr/phys/antim-Thee.html, accessed on 11 May 2023
[82] https://home.cern/science/accelerators/antiproton-decelerator, 11 May 2023
[83]https://www.worldscientific.com/doi, accessed on 12 May 2023
[84] https://www.npl.washington.edu/majorana/majorana-experiment, accessed on 12 May 2023
[85] https://campuspress.yale.edu/moorelab/exo-200, accessed on 12 May 2023
[86] https://www.hopkinsmedicine.org/health/treatment-tests-and-therapies/positron-emission-tomography-pet, 13 May 2023
[87] https://aceproject.org/ace, accessed on 13 May 2023
[88] https://www.nasa.gov/mission_pages/station/research/alpha-magnetic-spectrometer.html, accessed on 11 May 2023
[89] https://en.wikipedia.org/wiki/Alpha_Magnetic_Spectrometer, accessed on 11 May 2023
[90] https://www.energy.gov/science/doe-explainsquarks-and-gluons, accessed on 11 May 2023

[91] Paul Dirac: Mathematics Genealogy Project, https://en.wikipedia.org/wiki/Paul_Dirac, accessed on 11 May 2023

[92] Bhabha, Homi Jehangir, On cosmic radiation and the creation and annihilation of positrons and electrons (PhD thesis). University of Cambridge, 1935

[93] https://journals.aps.org/prl/abstract/10.1103/PhysRevLett.97.261802, accessed on 13 May 2023

[94] https://www.sciencedirect.com/science/article/abs/pii/S0370157301000825, accessed on 13 May 2023

[95] https://link.springer.com/article/10.1007/BF02059942, accessed on 15 may 2023

[96] https://home.cern/news/press-release/cern/antimatter-atoms-produced-and-trapped-cern, accessed on 15 may 2023

[97] https://cosi.ssl.berkeley.edu, accessed on 16 may 2023

[98]https://ui.adsabs.harvard.edu/abs, accessed on 15 may 2023

[99] https://pamela-web.web.roma2.infn.it, accessed on 16 may 2023

[100] https://www.britannica.com/science/pulsar, accessed on 16 may 2023

[101] Baumann D., The Physics of Inflation, University of Cambridge, 2011

[102] https://arxiv.org/abs/0802.2962, accessed on 16 may 2023

[103] https://bigthink.com/hard-science/matter-antimatter-half-universe-missing, accessed on 17 may 2023

[104] Fixsen D. J., The Temperature of the Cosmic Microwave Background, The Astrophysical Journal, 2009

[105] https://www.bbcearth.com/news/why-is-95-of-the-universe-missing, accessed on 12 May 2023

[106] https://www.nasa.gov/press-release/goddard/2021/technosignature, accessed on 13 May 2023

[107] https://www.bbc.com/future/article/20221101-should-extraterrestrial-life-be-granted-sentient-rights, accessed on 15 May 2023

[108] https://worldbuilding.stackexchange.com/questions/39571/how-far-away-would-an-alien-civilization-need-to-be-for-us-to-not-notice-them?rq, accessed on 12 May 2023

Cite this Article: Khandakar Akhter Hossain (2023). Evaluate the Mystery of Creation of Universe and Existence of Antimatter, Dark Matter and Dark Energy. International Journal of Current Science Research and Review, 6(6), 3581-3600