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A Review on Time Travel: Fact or Fiction

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ABSTRACT- This article focuses on Einstein's theory of relativity and Minkowski space-time, which combines three dimensions of space and a fourth dimension of time. It contrasts and examines the evolution of time travel in science fiction and science. The wormhole hypothesis and the Tipler cylinder are among the time travel hypotheses investigated, as is the possibility of human time travel. This research investigates time as a fourth dimension, as well as curved space-time, both of which are often overlooked. The paucity of information about time was one of my major realizations throughout my studies, and I liked investigating time as a social construct. Given how seldom we ponder the effects of actions in our everyday lives, the amount of hurdles to successful time travel was especially apparent. Time travel was hampered by paradoxes, such as the grandfather paradox, but I discovered techniques to solve them throughout my studies. I also considered the societal and economic implications of time travel, knowing that the risks are numerous and could encourage corruption in our cultures.

KEYWORDS- Entropy, Paradox, Science, Time, Universe

I. INTRODUCTION

Time travel was originally exclusively a science fiction notion, but it is now gaining traction in theoretical physics, with experts across the globe searching for a solution that might change society as they know it, as well as our past and future. This book examines the concept of time in depth, including how it affects us all and our capacity to navigate it. This subject appealed to me because I appreciate theoretical physics and delving into areas previously considered to be unattainable. Time travel puts our human reasoning to the test and exposes us to new concepts, which is why I'm so fascinated in it. I'll be delving into the enigmas of time travel, echoing Albert Einstein's famous words, "People like us, who believe in physics, recognize that the distinction between past, present, and future is merely a stubbornly persistent illusion."[1][2].

But, before we can comprehend the phenomena of travel, we must first comprehend the concept of time. Time has been a mystery for ages, dating back to cavemen who have used little etchings on rocks to keep track of days. Who decided that a day is 24 hours long and a minute is 60 seconds long? It was we, the people, who were to fault. Humans developed the time unit we use, and it is unique to ourselves and our planet. Aliens on a planet 3 million light years away would have a different way of calculating time, giving the concept of time a whole new meaning. We structure our lives around the notion of time in order to preserve some kind of order, yet we can't even control it since it's a social construct established by people for humans. The most important aspect of time, according to Carlo Rovell, is that it is an arrow which never stops flowing. Time, unlike other physical concepts, goes exclusively in one direction: forward. This demonstrates that no matter how hard we attempt to 'live in the now,' we will not be able to since our present is always changing. Even though you read this, the time it would take for the light from the pages to reach your eyes indicates that you are doing it in the past[3][4][5].

This is related to my second point, which is scientists' lack of understanding of time. Throughout my research, I learned that we know a lot more about what time isn't than we would about what time is. Einstein produced one of these discoveries, which he published in his book 'Relativity: the Special and General Theory': Time passes more quickly so a higher-up object is subjected to less gravitational attraction. This demonstrates that rather than being uniform and absolute, time is relative. We also understand that time does not go in a straight line [6].

The spreading out of the energy of the atoms is measured by entropy, or the degree of chaos in a system. What sets the past different from the future? The sole equation in all of science that achieves this is Clausius's 2nd law of thermodynamics, which he developed in 1854: where " is the change in entropy (a measure of disorder) (a measurement of disorder). This means that heat can only be transferred from hot to cold bodies in one direction. The only thing that separates the past from the future is heat, which is produced by the microscopic agitation of molecules. As a result, we come to see that the only variation between the history and the future is our distorted viewpoint. It's possible that our inability to see at a microscopic level is what provides us with a past and a future. It's possible that if we could see at the microscopic level, we'd find out that we knew just as much about the future as we did about the past. Another certainty that may have existed at one point in time has disappeared[7][8].

Philosophers like Aristotle, who lived before the institution of regulated time, have pondered the topic of "what time is." He said that time is a measure of the difference, and that no time has passed if nothing has changed. This brings up the obvious question of 'how long does time pass in silence?' Since the act of measuring time at no point of change is a change, causing time to change, it is still time. Newton, on the other hand, advises the polar opposite. He refers to Aristotle's understanding of time as "Relative

time," claiming that "real time" is untouched by something and continues apace. The issue of whether Newton or Aristotle is accurate remains unanswered. I'll leave it to you to consider it[6][9].

II. LITERATURE REVIEW

H.G. Wells was the first to merge these two seemingly unrelated phrases into something amazing in his novel The Time Machine. Even as a theory, time travel took a long time to be discovered, and it wasn't until after the industrial age that individuals began to investigate the possibilities. This is most likely indicative of the fact that the industrialization was the first time in human history that such fast technical improvement occurred in a single lifetime[10][11].

Kurt Gödel was a German mathematician. In 1949, he devised the Gödel Metric, which is a solution to Einstein's field equations. The Gödel Metric portrays a planet revolving with a rotational acceleration of: where 'a' is a free constant. Closed moment curves are predicated on the concept that if you leave anything alone for long enough, it will revert to its original state and time will circle back on itself. Its space-time coordinates would remain unaltered, giving us with a time travel mathematical formula. Many scientists, on the other hand, feel that Gödel's solutions will have no real-world implications and that future time travel would be impossible. One of the most common complaints is that his method is dependent on the idea that our cosmos has spin, which physicists concede is dubious. The value of the cosmological constant(), which should be adjusted according to the density of the dust particles, is another reason Gödel's cosmos is artificial. It was discovered by Einstein, who included it into the field equations in order to balance gravity's effects and, at the time, allow for a static universe. Despite the lack of proof, time travel became fashionable in the twentieth century. Despite the absence of practical applications, theoretical physics has been a success[12][13][14].

Hermann Minkowski was accountable for Einstein's major breakthrough, which incorporated the notion of a fourth dimension, similar to the one depicted in H.G. Wells' novel. Surprisingly, what began as a joke rapidly turned into a reality. Time, which is a mathematical description of space-time as a continuous continuum, is the fourth dimension. It is now used to explain special relativity because it permits particles to travel and interact across the cosmos without taking gravity into account. Large objects, such as the Earth, may bend and modify space-time around them, resulting in curves, according to Einstein's theory of relativity. The first and only step toward our comprehension of time travel is his premise, which argues that the quicker you go, the slower time passes. As a result, if you traveled at near-light speed, time would pass considerably more slowly for you, and you would only discover the repercussions when you returned to the motionless humanity you had left behind. They'll have developed far faster than you have[15][16][17].

III. DISCUSSION

Time travel is a riddle in and of itself, full with contradictions that make it seem impossible. Scientists utilize several of these flaws to reject the hypothesis of time travel. The grandfather problem is the only well of temporal paradoxes. This is the conundrum that would arise if you murdered your grandfather once he had children, thereby prohibiting you from being born. You've effectively murdered yourself, so you'd never go back in time to assassinate your grandfather in the first place. An incoherent causal loop is the term for this situation. Someone flying back in time to murder Hitler is another example of this paradox; if they succeed, Hitler will no longer be significant in the future, and there would be no need to travel back in time in the first place. As you can see, this is a significant issue since time travel is not conceivable if these issues exist. The Bootstrap paradox, also known as the ontological paradox, is another example of a contradiction. When an object or piece of knowledge is transported back in time, it generates an endless loop in which the object's origin is unknown. The ontological dilemma is highlighted in the Terminator film because Skynet would not have been able to exist without the T-800 synthetic monster sent back in time to stop John. It's a closed-loop situation, akin to the pedestrian paradox, wherein cause and effect are looped until the origin is forgotten. Even though the bootstrap paradox is logical, it violates fundamental physics rules like causality, since a past cause cannot be used to predict a future occurrence because the previous event might have been caused by a future event. The pedestrian paradox is a temporal paradox in which traveling into the past leads an item or person to get entangled in earlier occurrences to which they were most probably returning to halt in the first place. As a consequence of this inconsistency, history must be pre-written and subject to change, and any attempts to intervene will only help to perpetuate previous occurrences. Polchinski's conundrum is the last contradiction to be investigated. Joseph Polchinski established this in an unpublished letter to Kip Thorne. It is stated that if a billiard ball is carried into the past via a wormhole and then collides with its previous self, the billiard ball will not join the wormhole at all. This inconsistency is based on evidence that supports Einstein's idea and lends credence to it. While all of these contradictions make time travel seem like a pipe dream, there really are solutions. Dealing with these challenges may be approached in two ways:

• According to the many universe idea, for every activity you perform, there is an other world where you did not take it. So, if you travel back in time and kill your grandfather, you've established a different timeline, and if you returned back to the present inside that timeline, you wouldn't exist.

• The timeline protection concept is another method to resolve the issue. In this scenario, the chronology would prevent events that might disrupt it from occurring. As a consequence, you'd never be able to murder your grandpa, since the pistol would never fire or your knife would missing the mark[18][19].

Despite the fact that every one of those ways renders paradoxes meaningless in the face of time travel, new

hypotheses continue to emerge arguing that our universe was not meant for it and cannot withstand its consequences[20][21].

Stephen Hawking is one of these individuals, having proposed the Chronology Protection Hypothesis, which is adamantly opposed to time travel. It claims that time travel is only possible on a very small scale, and that the universe's laws forbid all time travel save for that. Time travel becomes substantially more difficult since no closed time-like curves can be built. It's also worth mentioning that if time travel were conceivable, we'd be flooded with visitors, but there's no evidence to back this up, implying that time travel would be limited to a chosen few or impossible. Furthermore, since the 'weak energy condition' claims that power must always be positive, no negative mass can exist, it disproves any conceptions of time travel. The reason this is such a major concern is because negative mass is required for a closed time loop to occur, which does not exist right now. Science has hit a snag, and further research into closed time loops is required to expand our understanding of space-time. Scientists have also advocated against going into the future, with Richard Muller being one of the most well-known participants in the discussion. As observed via CMBR, he says that as space expands, time grows as well (cosmic microwave background radiation). The future does not exist; it is being produced right now, and we are on the verge of experiencing it. This suggests that entering something which doesn't exist is impossible. Due to the immutable principles of physics, traveling through time is becoming more dismal by the second[22].

I came upon Mallary, Khanna, and Price's Classical and Quantum Gravity article during my investigation. This newly published study is crucial in the hunt for time travel methods that do not violate physical laws. It meets the weak energy criteria (which asserts that for vacuums to be stable, the local mass-energy density must be negative), an issue that most prior theories have failed to solve. They used naked line singularities (NLS) to explain their findings: a point in spacetime without an event horizon where a body's gravitational field becomes limitless. Because'superluminal transit is conceivable' parallel to the NLS, they may be used to create closed time-like curves by cutting across areas in spacetime. Two positive-mass autos are parked opposite to each other in their model. One automobile accelerates while the other remains still. A temporal loop might form in the space between the autos. Because the items in question have positive mass, this theory avoids breaching the weak required energy, implying that this 'requirement isn't sufficient to rule out superluminal transmission.' NLS, on the other hand, have never been seen in nature, even if loop quantum gravity (a theory that integrates special relativity with quantum field theory) is correct. Forces and elementary particles may be represented in terms of the physical and virtual field pairs using the unified field theory. This book has changed my mind regarding time travel, and I'm curious to learn more about the concepts that are congruent with the weak energy state[23][24][25].

A. Impacts of time travel

Regardless of time travel's scientific promise, there are a slew of moral, economic, and cultural concerns to address. Who would want to utilize time travel if it became a reality one day? Would it be restricted to scientists and the wealthy, or would it be open to all? If the answer is true, the wealth disparity between rich and poor will rapidly expand. If the wealthy continue to travel across time, they may become further affluent. This isolation would result in increased distrust between the two groups, as well as higher rates of aggressiveness, such as gang-related crimes, which are statistically linked to poverty. On the other hand, if time travel could be made affordable enough to become a substantial part of the technology sector, the industry's economy would boom, and workers' pay would rise. As a consequence of the greater compensation, workers' disposable income would increase, which they would consume and employ in the global economy. Everything would eventually revert to its previous condition. Those in the bottom tenth of the income distribution, on the other hand, will never again be able to buy this new mode of transportation; they will be left back and therefore unable to travel back in time like the rest of the population. Due to the utilization of information, time travel might have a significant economic effect. People may be able to invest in stock markets in the past after witnessing which ones succeed. They may even go back in time and win the lotto; the options are unlimited, but they all have one trait. People may travel back in time and develop things before the original idea, patent them, and make a lot of money, drastically decreasing the value of knowledge. Furthermore, since we may travel back in time and explore whether Jesus lived or who was Jack the Ripper, the past's mystery has evaporated altogether. This may seem to be a good thing at first since many of the world's secrets are being revealed, but knowledge in the wrong hands might be a devastating weapon. Terrorists may use time travel to more accurately plan bombing targets. Time travel may also be used by armies to win wars and, in effect, affect the future. The biggest issue with time travel is semantics: once you've traveled to the future, you're no longer there; you've arrived in the present. We are now stuck in the present tense, regardless of how much time has passed. Time manipulation might lead to the formation of new parallel worlds or the perception of a parallel reality instead of the future[1].

Given the possibility of time travel, there are inescapable risks. One of them is knowing where you're going. Because the Earth circles on its axis, the point from which you go will differ from the one at which you arrive. It's conceivable that you've wound yourself in the open sea or lost your way in space. The farther back or forward in time you go, the more difficulties you'll likely face. Our environment is always changing, especially as a consequence of global warming. As a result, growing CO2 levels in the future atmosphere may render human existence unsustainable to sustain. As a consequence, your body will be habituated to the environment when you arrive, resulting in your death. This is also true when going back in time for a lengthy period of time. Because carbon dioxide levels were greater in the Jurassic period than they are today, we would suffer similar challenges because our

bodies have not developed to filter out considerable quantities of CO2. Furthermore, since our body's germ resistance is specific to our age, time travelers may be affected by past and future diseases. In general, time travel hasn't been extensively considered, and it has a number of unforeseen consequences that may be neglected. Even in fiction, most problems are ignored, and time travel is presented as less troublesome than it is in reality[15].

B. Portrayal of time travel within pop culture:

Because science fiction is where time travel began, I looked at numerous portrayals of time travel in science fiction (books, films, and TV episodes) for my research. 'Doctor Who - our resident time lord' is one of the most popular. Time lords utilize the TARDIS to traverse spacetime, which is essentially a bubble of spacetime that moves in tight time-like arcs, in this series. Benjamin K. Tippett and David Tsang presented a study suggesting a model for the TARDIS to use in order to travel across time more effectively. Despite the fact that Time Lords are supernatural beings, they must adhere to a system of rules in order to keep the world from collapsing. They can't change history': this restriction is beneficial in practice since it prevents the grandpa or Hitler dilemma from arising, preserving the global order. Every object has a unique world-line that depicts the thing's journey throughout space and time. The notion of 'fixed locations' is another fascinating topic. They are events that, in order to preserve the timeline's integrity, cannot be changed or altered in any way. This is related to the previously mentioned timeline protection idea, which ensures that the universe is consistent. In 'Doctor Who,' time travel complies with a wide range of scientific standards and avoids the bulk of paradoxes. However, they do neither explain or prevent the production of closed time-like curves, which remains one of the most problematic aspects of time travel today[12].

Furthermore, 'Harry Potter' employs time travel for routine jobs as well as saving lives, most notably in the third book of the series. 'Time turners' are little gadgets that enable you to go back in time for up to 5 hours securely. In the wizarding world, traveling for any longer would have devastating consequences, such as the traveller's body aging significantly, resulting in their death as well as the un-birth of many of their family members owing to temporal shifts. That might be one of the reasons why it's only utilized for minor concerns. Due to the absence of problems, that might be the only time travel option we've been able to investigate. Because no reality exists whereby the event does not occur, this kind of time travel only occurs in books, and so supports the single-verse hypothesis. This is in direct opposition to the multiverse idea, which many scientists think is required for time travel to be possible, and shows a predetermined history. Nothing is ever changed in this timeline because it has always been changed without your permission. Although not practical, this timeline eliminates the grandfather paradox. On the other hand, it exacerbates the ontological contradiction since things lose their genesis because they were always meant to be there. Within 'Harry Potter,' time travel was likewise tightly restricted by the government and only granted to Hermione for certain reasons. To avoid exploitation, only the professors and Hermione knew about it[22].

The last time travel portrayal I looked at was in The Flash; in this series, time travel is frequently accomplished by sprinting at very high speeds (often faster than light) and then selecting a location. When comparison to other literary works I've examined, the world concept in 'The Flash' is incredibly inconsistent. It seeks to avoid the vast majority of paradoxes by following a fuzzy multiverse hypothesis with a "Earth-1" and a "Earth-2." The fact that practically everyone who walks across time in these novels, programs, and reality isn't human is a significant distinction. These views are able to disregard the consequences of time travel on the normal body and psyche because they are a supernatural race. In fact, this is not the case since humans are a frail species with systems that are vulnerable to a number of pressures, including time travel's effects. Due to the limits they must adhere to, Doctor Who's concept of time travel looks to be the most cohesive and practical of all the media I reviewed. Furthermore, the indicated 'fixed spots' make it possible to follow a more accurate picture of our reality[7].

IV. CONCLUSION

Time travel is a tough concept that puts our thinking and the basic physics principles that underpin our universe to the test. Due to the stringent conditions (speed, etc.) required for time travel to occur, there is just a sliver of evidence. Einstein's relativity theory has been the principal supporter of time travel throughout history. It was determined during this investigation that major changes in our velocity cause the laws that control our environment to shift. However, even with today's technology, the requisite speeds are not achievable. The speed of light is the most apparent impediment to human travel across space-time, and efforts must be taken to overcome it in order to make further technological progress toward building a workable time machine. Although physics may prohibit us from attaining light speed since it necessitates an endless mass.

The most plausible model of time travel, in my opinion, is black hole theory, which, like the Triple Cylinder, requires a'ship' to fly swiftly around a black hole to become stuck in time loops. This theory appeals to me that the most because black holes are real, as opposed to the bulk of the other theories, which are based on speculation. However, nothing is known about what occurs when one passes through the event horizon; everything may be annihilated, eliminating the requirement for time travel black holes.

Personally, I believe that, although time travel is do more and occurs on microscopic scales, the universe as a whole has restrictions that we will never be able to overcome. Time travel is more of a science fiction with present technology, but as technology progresses, we may be able to create items that can resist the pressure of superluminal flight. However, since the hazards involved with time travel are potentially deadly, it may be in everyone's best interests if it is kept a secret. Any new invention should be assessed to determine whether the advantages exceed the hazards. I don't believe they do in this scenario. Chaos erupts as a result of the ability to travel beyond time, breaking the universe as we know it. Many people will

attempt to profit from the opportunity provided by time travel because of their own personal gain. Physics has led us on a fantastic journey, from Newtonian mechanics to nonlinear dynamics, but who knows what will happen for humanity?

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