Particle Accelerator: The Key to Time Travel

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Abstract

This research paper explains the possibility of achieving time travel through the particle accelerator by colliding two particle beams moving at an absolute speed and smashing a hole in the space-time reality. Provide a hypothesis of using a different energy source to increase the power of the electromagnet and accelerate particles to the greatest speed that is known in the universe. The research has been done by collecting information from other physicists and their theories on time travel including Albert Einstein's theory of Relativity, Stephen Hawking's theory of Black Hole, and the discovery of the Higgs Boson. Proving that human understanding is still so small compared to the actual knowledge of the universe. It also discusses the consequence of time travel and the theory of the multiverse as to how they would affect reality. Indicate that the capability of particle accelerators in quantum physics research is unlimited. The greatest scientific instrument that has ever been created that would lead to an answer to the fundamental question of time travel. The paper is produced to advance people's understanding of physics and the general world, knowing that reality and the complexity of matters are not like what they seem.

1 Introduction

For centuries, scientists, especially physicists, who are known as the smartest human beings in history, have been researching the question of time travel, the key to return to any events that happened in the past or to go to the future. Over the past decade, more scientific discoveries in the world of quantum physics have revealed the possibility of achieving time travel through the particle accelerator, the only machine that can accelerate particles to the fastest speed that needs to disrupt the space-time continuum and prepare for a collision that would open the portal to time travel. Just like the way one travels to work every day, the portal is similar to a highway where you can choose any destination at any point in the past, present, and future with no limitations. The research about the accelerator would change people's understanding of science and reality in general, seeking to uncover the truth about the universe and modifying human observation from a quantum physics point of view.

2 The Fastest Speed Possible

According to Einstein's theory of special relativity, space and time are parts of one thing, space-time, related to each other, and we should be as willing to think about distance in time as we are about distance in space. From that, he linked the relativity of space and time to mass and energy, creating the world's most famous equation: $E = mc^2$, as the amount of energy generated by n-gram of mass multiplied by the square of light speed. The article, The Conversation (2018) states "As physicists Brian Cox and Jeff Forshaw write in their book *Why does* $E = mc^2$?, time and distance 'can be interchanged using something that has the currency of a speed' Einstein's intellectual leap was to suppose that the exchange rate from a time to a distance in spacetime is universal" [1]. The disruption of space-time is related to the speed an object is traveling - the faster it goes the more distinction in time occurs. When it reaches the absolute speed which is the speed of light, space and time would be imbalanced, causing unpredictable effects that scientists tried to understand for centuries. An example of this would be a person traveling back toward the Earth at an incredible speed, the time it would take for them would be less than someone observing from Earth based on what we know about Einstein's theory. So, if an object could travel with the speed of light there is a chance that it could make time go backward and "replay" the past.

If an object is moving at light speed, it would take approximately 8 minutes to travel from the Sun to Earth which is about 93,000,000 miles [2], so the sunlight human see every day is from the past (8 minutes ago) according to Special Relativity. Furthermore, Einstein's equation can also be express as

$$c = \pm\sqrt{\frac{E}{m}} \tag{1}$$

(with $c \approx 299{,}792\ km/s$) meaning reaching the speed of light requires an infinite amount of energy and that would be impossible if the object has mass. The only thing scientists have found so far that can move with such a speed is the photon of light which has no mass. But what if we plug in the equation something similar to that, an object with very tiny

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interaction with gravity-like particles-then there is a chance that it could achieve the speed of light. But particles aren't getting faster by themselves, they need interactions with other fields and the question is how could we make them move as we wish? Scientists have been looking for the answer for years, and by borrowing the idea from J. J. Thomson who discovered the electron, they were finally able to conclude that using a machine called a particle accelerator as the tool to research questions about the universe.

3 The Particle Accelerator

Particle accelerators are scientific tools that can speed up particles that make up all matter in the universe by using electromagnetic fields while containing them in well-defined beams. Particles after accelerating to a certain speed can be guided to collide with each other or hit a target [3]. Physicists use particle accelerators to conduct their research on subatomic particles such as protons, electrons and others particles that are still hidden from their observation. A collider or atom smasher is one type of particle accelerator that accelerates two beams of particles in opposite direction and have them collide after reaching a certain high speed that can vary depending on how the experiment requires it to produce other particles.

The particle accelerator isn't a newly invented technology, it has been used for a long time. According to The Evolution of Particle Accelerators & Colliders by Wolfgang K.H. Panofsky [4], "When J.J. Thomson discovered the electron, he did not call the instrument he was using an accelerator, but an accelerator it certainly was. He accelerated particles between two electrodes to which he had applied a different electric potential." The "instrument" was used to discover the existence of electrons in 1897, and it has since become indispensable in the quest to understand nature at smaller scales and is becoming more advanced as the world is developing.

By using superconducting electromagnets, the atom smasher accelerates particle beams by having them interact with the electromagnetic field. Scientists use beams of protons that have a positive electric charge to be pushed by electromagnetic force from those magnets. To gain speed, particles need to travel a distance in a specific amount of time according to the kinematic equation $(s = \frac{d}{t})$, but it would cost a lot of materials to build a machine big enough for the particle beam to reach a certain high speed, so they decided to create a circular in which particle will be able to travel over the same field multiple times. Inside the accelerator, two high-energy particle beams that travel at close to the speed of light in opposite directions in separate pipes are made to collide. They are guided around the accelerator ring by a strong magnetic field maintained by superconducting electromagnets that are cooled down to -271.3 *C*- colder than outer space [5]. The collision would then be recorded and analyzed by physicists to discover new achievements in particle physics.

The world's leader in particle physics research is The European Organization for Nuclear Research, also known as CERN where they built the Large Hadron Collider (LHC)-the largest and most powerful particle accelerator in the world. CERN's primary mission is to perform world-class research in fundamental physics and seek to answer questions about the universe. According to CERN, "The LHC consists of a 27-kilometer ring of superconducting magnets with a number of accelerating structures to boost the energy along the way."[5] In order to detect new particles or their signs, the LHC has multiple detectors, one of them is the ATLAS-the major detector at CERN which is used to investigate a wide range of physics.

After the establishment of CERN, human understanding of science has changed, more particles that make up the universe have been discovered, and the LHC has proven that nothing is impossible. Scientists know that the particle accelerator at CERN would be the key tool for them to uncover more truths about the universe, and even crack the biggest code of time travel. The extraordinary speed that particles can achieve at their particle accelerator is very close to the speed that needs to interrupt space-time, and yet, the collisions have not yielded evidence of time travel. Scientists from all around the world were able to conclude that the only way to time travel is for the particles to reach the speed of light, and the solution would be an alternate/new energy source that can provide more power for the electromagnet.

4 The Optimal Energy Source

The electromagnets are still not powerful enough to push particle beams to the speed of light because of the limitation of electricity voltage, and we could not find something that has "that much" energy even though the mass is already very small. There are many theories on how we can improve the power of those magnets, one of them is to find an alternative energy source. But which one? The tricky problem makes physicists struggle for decades while figuring out other fundamental discoveries at the accelerator. While remaining unsolved, an idea of using tachyons which is a hypothetical subatomic particle that travels faster than the speed of light to power those magnets appeared. The existence of tachyons, though remains a theory, appears consistent with the *Theory of Rela-*

tivity. If we could find a way to conduct tachyons to generate energy and power up the electromagnets, it would be strong enough to accelerate particles to light speed.

The particle accelerator then will need a revolution of upgrading to handle particles moving at such a speed because humans are about to create something that is beyond our understanding. The accelerating pipe has to be rebuilt and use special materials that can contain particles, and the accelerator needs to be completely isolated from all other objects because the superpower conducting magnets would draw anything to its side. The detectors now have to be reprogrammed with more advanced computers to detect any evidence of the discovery. A backup nuclear container should be equipped at the collision point in case something goes wrong and causes a nuclear reaction.

5 The Portal of Time Travel

Ten years ago, on 4 July 2012, scientists and journalists gathered at CERN, and remotely around the world, for the announcement of the discovery of a new fundamental particle, the Higgs boson. The discovery, by ATLAS1 and CMS2 collaborations at the LHC, came almost 50 years after theorists had postulated the existence of such a particle. The significance of the discovery was not only that a new, long-awaited particle had been found, but that the existence of this particle provided the first direct evidence that surrounding us there is a new kind of fundamental 'field', known as the Higgs field[6].

The Higgs Boson discovery has proven that the particle accelerator's capability is unlimited. The experiment was done by launching two beams of protons into the acceleration pipelines in opposite directions and accelerated them close to the speed of light, then collided together with a significant amount of kinetic energy generated when the particle beams sped up, the collision yielded the Higgs boson, which is also known as the God particles because the importance of such particles. The universe would be a fundamentally different place without it. Life and stars couldn't exist because every matter in the universe have its mass and that mean they must interact with the Higgs field, except photon of light, that is the reason why it can travel with that high of a speed. The Higgs field can be metaphorically compared to a field of snow that exists in any location of space and time in the universe, where the Higgs Boson is the snowflakes and everything you put on the field of snow would leave a signature, the heavier object weighted, the more interaction with the Higgs field it does.

When scientists figure out how to apply energy from tachyon particles into the accelerator and then launch two exact particle beams of protons that they used to discover the Higgs boson into the accelerator pipeline, they would be able to achieve the speed of light, breaking the barrier of space-time and then collide together. The kinetic energy of the collision generated so large that it would smash a hole in the space-time reality, opening a portal to some indeterminable place. The imbalance between space and time will suck every matter that ever existed including light into it, trying to rebalanced the whole reality, the portal that the accelerator just opened could also be known as the wormhole or black hole. Then, scientists need to figure out how to stabilize the black hole so we can use it to access the unknown place that lies parallel to reality. They need to be very careful in calculations because if there is a small mistake, the black hole will swallow the whole solar system in. According to Einstein's Theory of Relativity, the time surrounding a black hole would slow down as a clock moving toward it relative to time far away from it [1]. So, if an object enters the black hole, its time will be reversed but for those who are observing it would be the same. The object would eventually enter the portal of time travel and it would return a random event in the past and appear out of nowhere.

6 Understand the Reality

What is space? What is time? Is time a classical clock ticking in the galaxy? Most people don't know the exact answer to such questions because human understanding is still so small compared to the actual knowledge that is required to understand the universe. Space is not empty it's filled with matters including dark energy which makes up approximately 68% of the universe and dark matter about 27% of the universe [5], it is filled with pairs of particles that pop in and out of existence. Time is not the big hand or the little hand of the clock, time is the progression of events from the past to the present into the future [7], time is not absolute (Einstein)-it's not the same everywhere, and there is a beginning and there is an ending.

7 The Effects of Time Travel

Like other fundamental science discoveries, time travel also has advantages and disadvantages. One of the biggest problems of travel through time is the paradox, a good example of this would be the "grandfather paradox" if you travel back in time and kill your grandfather before your mother or father

was born, you could prevent your own birth [7]. The moment a person enters the portal, things will not be the same as before they left. People can come back to life or die. If one makes a tiny change in their past, the disruption in the timeline could be so large that reality will not be the same as before. If the purpose of time travel is to fix something in the past so the bad thing will never have happened in the present, the much worse effects of doing that will apply to reality, the more one tries to fix it, the worse the effect would be.

If there is a small mistake in physicists' calculations, the collision at the accelerator can result in a significantly different way. Instead of opening a portal to time travel, they could create a portal that links our universe to a parallel one or a different dimension that exists parallel with ours. The collision could snap the universe and create an infinite number of parallel universes where a person is not actually who they think they are, their memories will be altered and they will be completely different from the original universe. The discovery of time travel would change human understanding of physics and redefine knowledge of the reality we have known so far, unlocking the door to further understanding of the universe. Scientists' curiosity will not fade away and the passion of seeking the answer will continue expanding as more discoveries will be made.

8 Conclusion

The particle accelerator is what we are looking for to answer the question of time travel. The more advanced the accelerator is, the more likely it will yield a discovery. As the world is developing at an aggressive speed, the possibility of achieving time travel is just the problem of time. Scientific discoveries at the accelerator are proving that there are many more mysteries in the universe that we need to solve, and our understanding is unlimited. Time travel would be a revolution in the world of physics and science in general.

Disclosure Statement

This paper was originally written by Khang Luong during high school for College Prep Writing (Semester 1) and has been revised currently. Please note that some information presented may not be fully accurate or up to date. This paper is intended for general interest and entertainment purposes only. The author declares no affiliations, memberships, funding, or financial interests that could be perceived as influencing the objectivity of this work.

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References

[1] The Conversation. *Stephen Hawking's final book suggests time travel may one day be possible—here's what to make of it*. https://theconversation.com/stephen-hawkings-final-book-suggests-time-travel-may-one-day-be-possible-heres-what-to-make-of-it-106566. Accessed: 2023-09-15. Nov. 2018.

[2] A. Thompson. *A Photon's Million-Year Journey from the Center of the Sun*. https://futurism.com/photons-million-year-journey-center-sun#. Accessed: 2023-09-15. Jan. 2023.

[3] Department of Energy. *DOE Explains...Particle Accelerators*. https://www.energy.gov/science/doe-explainsparticle-accelerators. Accessed: 2023-09-15.

[4] Wolfgang K.H. Panofsky. "The Evolution of Particle Accelerators & Colliders". In: *SLAC Beam Line* 27.1 (1997). Spring issue, 1–?

[5] CERN. *The Large Hadron Collider*. https://www.home.cern/science/accelerators/large-hadron-collider. Accessed: 2023-09-15.

[6] Gavin P. Salam, Lian-Tao Wang, and Giulia Zanderighi. "The Higgs boson turns ten". In: *Nature* 607.7917 (July 2022), pp. 41–47. DOI: 10.1038/s41586-022-04899-4.

[7] A.M. Helmenstine. *What is Time? A Simple Explanation*. https://www.thoughtco.com/what-is-time-4156799. Accessed: 2023-09-15. Nov. 2019.