Speed of light and time travel

Introduction

The prospect of time travel has mystified and intrigued mankind for centuries. Time travel has been predominant in our culture and has formed the basis of a large portion of science-fiction works including H. G. Well's " The Time Machine". Whether they want to go back to the past to correct a mistake or journey to the future to experience the growth of mankind, everyone harbors a desire to travel in time. However, time is elusive. Everything about it is a mystery, from its existence to its workings. Even now, we are traveling into the future at a rate of one second per second. We can travel even faster by using light to our advantage. Although mankind cannot manipulate time with the current limitations in technology, time travel seems to be an almost inevitable part of the future.

Einstein explains that places are moving at constant speeds relative to each other in his theory of Special Relativity. Soon after this theory was announced, scientists concluded that space and time were not really separate. They were actually part of the same entity, space-time, which is also known as the fourth dimension. And this allows us to travel through time. However, to perform a massive jump through time, the light speed barrier would need to broken. That is almost impossible with the present technology. However, new theories and hypotheses have been brought up which seem to signify that time travel could occur on a very large scale. By bending the laws of physics and light itself, we can theoretically travel in time. Indeed, theories about traveling in ultra-fast spaceships through the vast expanses of space to bending space-time have been brought up by numerous scientists. And the majority of these theories rely heavily on the use of light.

The Relationship between Light and Time

Light travels at a speed of 300, 000 km/s. This speed, named *c* , is invariant. So, if we perform calculations on an object, the fixedness of *c* would cause other measurements to become variable (Clegg, 20). If this object starts nearing the speed of light, it would undergo massive changes, such as time distortion. In short, the object would experience time differently than an object moving at a slower speed (Jones & Robbins, 281). This is known as time dilation. The effects of time dilation can be seen clearly when muons, particles with a life expectancy of 2. 2 microseconds that travel at 98 percent light speed, survive their fall to Earth from an altitude of 15 km (Clegg 22).

Einstein’s theories play a massive role in the understanding of time. Special Relativity proves that the time on a clock which is placed on a spaceship far from Earth passes much faster than the time observed on a clock close to the surface to Earth (Clegg 80). The other theory, General Relativity, shows that matter causes gravity and space to warp and light to curve (Jones and Robbins, 91). Gravity influences time, causing it to slow down. For example, atomic clocks situated in space gain an additional 46 microseconds every day. Experiments show that the two theories of relativity actually oppose each other (Clegg, 32).

As we approach the speed of light, time beings to slow down. For instance, consider a spaceship traveling with a speed close to 150, 000 kilometers per second for 10 years. It will fall behind by 2. 7 years by the time it reaches Earth because it travels at half the speed of light (Clegg, 83). Moving at a speed closer to the speed of light causes an object to move forwards in time. Moving at the speed of light causes time to stop for that object (Science Channel). It is only logical for relativity to suggest that if we manage to break through the speed light barrier, time might start flowing backwards. (Clegg, 20) However, it is impossible to guarantee that after breaking the speed of light things would continue in a smooth manner as the light speed barrier is a discontinuity in reality (Clegg, 23).

Breaking through the Light Speed Barrier

Using fuel to power a spaceship to reach a speed even remotely close to light speed is nearly impossible. That is because the mass of the fuel grows exponentially with the speed of the rocket (Parsons, 159). The Russian scientist Tsiolkovsky found out that the maximum speed of a rocket is proportional to the speed at which it spits out its exhaust (Benson). This causes ordinary engines to travel at a very slow speed. On the other hand, an ion drive, a type of spacecraft engine, generates exhaust speeds of over 200, 000 m/s. However, only a small mass of fuel is accelerated at a time, making the net acceleration very gradual. The fastest speed it can acquire is 700, 000 m/s which is only 0. 2 percent light speed (Parsons, 159).

It is more feasible to use solar sails, a new kind of spacecraft propulsion (Parsons, 161). The sun radiates electromagnetic waves, and the pressure of this electromagnetic output powers the solar sails. They work because light energy and electromagnetic radiation is converted to kinetic energy, which is essentially motion (Clegg, 91). Scientist speculate that it can achieve a speed of 75, 000, 000 m/s, about 25 percent light speed, when fused with an ion drive. (Parsons, 161) However, as the ship drifts off farther into space, it becomes harder for the sun to power it for a long period of time, and this might lead to its failure (Clegg, 91).

General Relativity could be used to build a ‘ warp drive’ that would allow a spaceship to travel faster than light. Mexican scientist Miguel Alcubierre envisioned arranging matter in such a way that would cause the space-time behind of the ship to expand and the space-time in front of the ship to contract (Alcubierre L73). By doing this, the piece of space containing the ship and its destination would be crossed extremely fast. In order to achieve this, ‘ exotic matter’, a material possessing negative pressure and mass, would be required. Unfortunately, only tiny amounts of exotic matter have been created experimentally. To produce a working warp drive, a quantity of exotic matter equal to a third of the mass of the sun would be required (Parsons 163).

The Possibility of Time Travel

Traveling at a speed close to the speed of light enables us to advance into the future. A brilliant example is the Twin Paradox (Clegg 83). To comprehend the Twin Paradox, it is necessary to visualize a pair of hypothetical twins first. If one journeys to space on a super-fast spaceship and then returns home after spending quite some time in space, he would find that he has aged far slower than his counterpart on Earth. By traveling at a speed close to the speed of light, he has would have effectively traveled into the future (Jones & Robbins, 291).

The laws of physics do not exempt the possibility of traveling faster than light (Mark 211). The warp drive does not damage any rules. Alcubierre states: “ When we study special relativity we learn that nothing can travel faster than the speed of light. This fact is still true in general relativity, though in this case one must be somewhat more precise: in general relativity, nothing can travel locally faster than the speed of light.” When warp drives are out of the question, scientists still think it is possible to find particles that travel faster than light, and some have already started challenging Albert Einstein’s claim that nothing can go faster than light (Padmanabha 8). Of course, that faster-than-light travel would probably violate the law of causality, or cause and effect (Mark 217), but that hasn’t stopped people from trying.

Nevertheless, it would be nearly impossible for a large object to break through the light speed barrier. Einstein was the first one to show us that mass and energy were interlinked (Jones & Robbins, 88). So it only goes to say that an object that is accelerating at a high speed would have to undergo an increase in mass. Therefore, a large amount of energy would be required to keep the body accelerating (Jones & Robbins, 282). However, as the object would start to approach the speed of light, the energy required to keep it accelerating would keep on growing until it becomes infinite at the light speed barrier (Parsons, 162). At that speed, it would be impossible to power to any object, unless its mass is zero, of course.

Conclusion

The speed of light allows us to experiment with time and manipulate it to successfully travel through time. Despite the many objections raised to this subject, the number of hypotheses surrounding this field of study keeps on increasing day by day. After all, in some instances, time travel has been proved to be successful. As the world progresses and technologies become more advanced, scientists start looking for ways to use the space-time dimension to establish time travel or prove the numerous theoretical possibilities false. Paradoxes and oddities keep on surfacing at every stage, leading people to say that time travel is impossible. They ignore the fact that time travel has been accomplished and that some people have already taken tentative steps towards venturing into the future.

Mankind has been in existence for a long period of time. As the human race progresses, it makes new discoveries in the field of science and technology everyday. Our conception of truth changes as time passes. The general populace sees time travel as something impossible. They believe that this only belongs to the genre of science fiction. However, beliefs tend to change. In the past, people used to find many ideas incredulous. With the passing of time, these concepts came to be accepted as facts. And today, these facts are taken as granted. Although time travel is not entirely feasible today, physics does make it theoretically possible. Maybe in the next couple of generations or so, mankind might attempt the first large-scale exploration of time. In the end, though, everything depends on time itself.