



## TECHNO–LOGICAL ASPECTS OF TIME TRAVEL

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**Abstract:** *A lot of human efforts have gone into determining and formalizing the validity of time travel. Various theories have been given so far, a few of them seem to be pragmatic, and a few seem to be only theoretically viable. In this paper we explore a few of the viable techniques like dilation of time and other factors, Alcubierre warp drive, hole teleportation and human teleportation. We have also focused on the both technical and logical aspects of time travel. Travelling in time is still a dogma and has many unanswered questions, we have unearthed a few answers as well ask a few of them. Ultimately it depends on the reader, his interpretation of the concept and his ability to perceive i.e. have mentioned a concept of amalgamation of Alcubierre along with other concepts in order to broaden the horizon of the ongoing research.*

**Keywords-** *Alcubierre warp drive, hole teleportation, human teleportation, dilation, amalgamation of technologies.*

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## **PAST TRAVEL- MIND SHIFTING PARADIGM:**

Looking at the current trends in technology and the logical aspects of going in the past, we are convinced it is not easy or rather not possible, though we wish to have an open mind. Travelling into the future is also limited by a number of factors in terms of the technology used, age of the person, body's bearing capacity. We have started to believe now that it's actually not time travel but travelling faster than usual and reaching the destination before the expected arrival. Logically time travel is nothing but fast travel. This paper deals with the technical and logical aspects of time travel and considers the principles like Lorentz force, Alcubierre effect, hole teleportation as the methods of time travel. A comparison with respect to other methods has been drawn to corroborate that these are the most viable methods keeping in mind their feasibility and obedience to the existing laws.

Is it possible to change the past or just visit it? If somehow we visit the past and alter it, then the change would be inevitable for everyone. So if 10 people go back in time and alter the past in 10 different ways then wouldn't that be self-contradictory and illogical. If the above statement also holds true then all the people must have travelled inter universe not intra universe and all of them had a world of their own which means that if all of us move back in time then there would be 'n' similar world. On the other hand, we think a more logical interpretation is that it might be possible to telepathically connect with the past. We can only perceive the past, we might think of being virtually present in the past but we certainly can't change the events that occurred.

If we could, we would have prevented Einstein from giving  $E=mc^2$  or the special theory of relativity which prevent the existing technologies from time travel. What if we go back to past and gift a time machine to ourselves then there would be no need to actually make one in the present. Time travel involves disappearance of objects in one time and reappearance in another, without its existence in the time interval between these events. So how can one go backward in time? To travel backwards in time, one has to cross a barrier i.e. the speed of light which is not possible for any matter or particle to achieve as it will require infinite energy.

Another logic which could play a vital role is if we are 30 today and we go back by 20 years so we would be 10 year old or would we be still the same age? We think it would be 10 because if it remains to be 30, then people would not recognize us but our parents must



know us so either we are 30 or there are another 'us' of age 10 which violates the basic laws of physics like conservation of mass and total energy.

Let's share another example, we take a train from Delhi to Mumbai today and it takes 24 hours for us to arrive at our home there. Our parents expect us at 4 pm tomorrow and we arrive on time.

Now consider another scenario, we take the same train and we arrive 3 hours before the stipulated time which is 1 pm. Now my question is: Is that time travel? In a way partially it is true because we arrived at our destination before expected. If we consider faster than light speed or near light speed as time travel then this ought to be time travel too.

Another point is that gravity bends the space-time around it, so if we create a zero gravity on my study table it means there would be no drag force on time and it will run faster than at other places, so it will not be wrong to infer that my table would move ahead in time than its surroundings though by a very small fraction.

There are 2 important concepts we would discuss here: in any of the theories stated we have not considered the expansion of universe or even the solar system since 'big bang'. Earth is not the same place as it was 1000 years back and probably won't be same after 1000 years so if we use any of the technologies for time travel we would actually not reach the expected place and time. What if we travel 1000 years in future and in the meanwhile a gigantic asteroid collides with Earth and destroys or shifts the position of Earth, where would we be then?

We must address the basic concerns first in order to move ahead with such hyper technologies.

## OUTCOMES OF TIME DILATION

Following the Lorentz theory, we studied the dilation of length, mass and time using the following relations in order to observe their variation and came to the conclusion shown in the coming figure (1)

$$L = \frac{L_0}{\gamma(v)} = L_0 \sqrt{1 - v^2/c^2}$$



$$\gamma(v) \equiv \frac{1}{\sqrt{1 - v^2/c^2}}$$

$L_0$  is the proper length (the length of the object in its rest frame),

$L$  is the length observed by an observer in relative motion with respect to the object,

$v$  is the relative velocity between the observer and the moving object,

$c$  is the speed of light,

And the Lorentz factor,  $\gamma(v)$

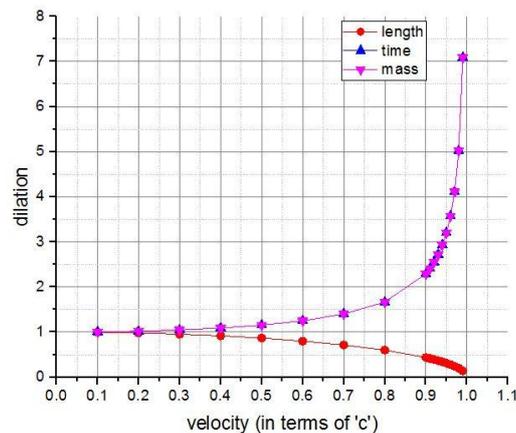


Figure 1- Dilation of various factors with velocity

The velocity 'c' equivalent cannot be attained and gives unexpected results. It can be concluded that the length of the object approaches zero as we near the speed of light whereas opposite is the case with mass and time. The graph is based on Einstein's special theory of relativity which considers an inertial frame of observation unlike the general theory of relativity. There will be a difference in the time dilation if we compare both the theories.

Well time dilation does remind me of the astronauts at the international space station. We know there is a time difference between the people on Earth and the people at ISS. So when they come back on Earth, are they coming to the future as time runs slower for them compared to time on Earth? There are still many unanswered questions in this direction.

So far the scientific community has considered all the aspects probably but the biological aspect.

Is the human body capable of handling such adverse conditions? Will the DNA of a person on a spacecraft remains same after the time travel? If we consider human teleportation the question still remains same?



It is also stated that humans can die in a vacuum like condition in a few seconds which has been tested by NASA as well.

Moreover when we approach the velocity of light, the interstellar hydrogen turns into intense radiation that is most likely to kill the people on board and dismantle the electronic circuitry as well unless we have another fuel in hand.

Based on the current scenario, we looked into the time elapsed by the observer on Earth and a person onboard spacecraft and noticed the time elapsed on Earth and on the spacecraft along with the acceleration and varying the distance in order to corroborate and find the relation in the time observed by both people.

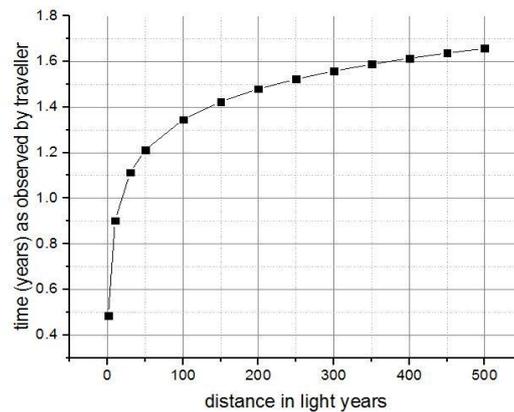


Figure 2 - Relation between distance travelled and time elapsed as per traveler

Following is the brief description of the observation: The time observed up to 1 light year was not much different for both the observers. It's when the distance started going above 10 light years we observed some change and though time would not become constant after few light years but it will approach constancy as shown above.

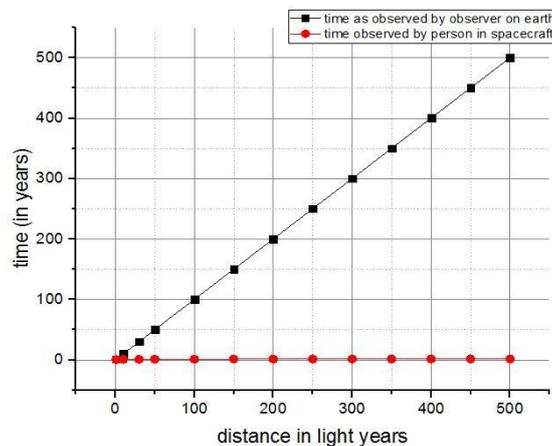


Figure 3- Relation between Distance and time observed



The line  $x=y$  is the time observed by a person on Earth, it is reasonable that as time would be changing at a constant rate with respect to a person on Earth.

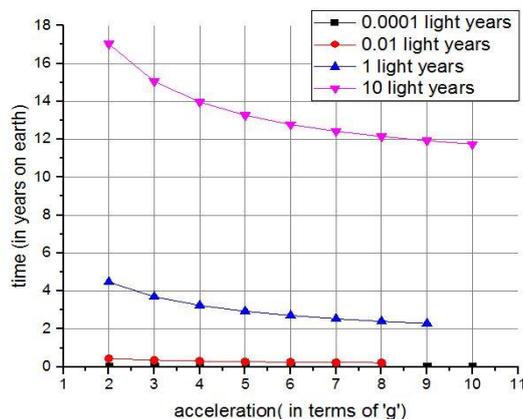


Figure 4- Acceleration of spacecraft vs. time (on Earth)

In the above initial figures we have kept acceleration of the spacecraft constant at 10 'g' but now we have varied the acceleration and checked it's relation with the distance travelled by the spacecraft. It is interesting to note that an observable change came in only for long distances (10 light years onwards).

You may notice that for distance 0.0001 light years there is hardly any change.

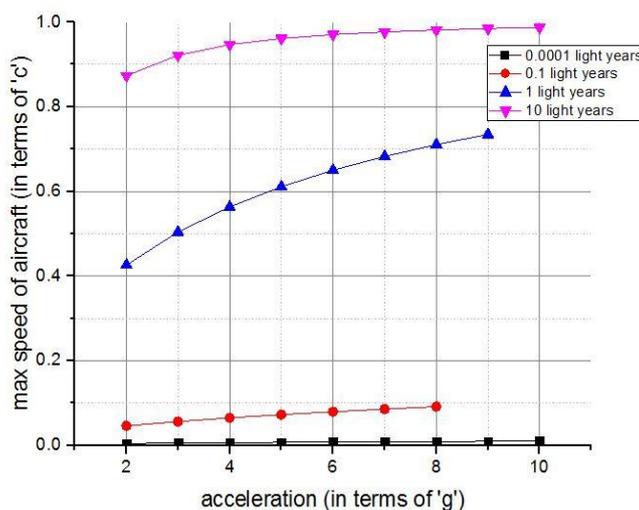


Figure 5-Acceleration vs. Max speed of aircraft.

In the above mentioned graph we have tried to check the maximum speed attained by the spacecraft at different values of acceleration keeping distance constant at different values.



If the distance is 0.0001 light years then the acceleration of the body has to be more than 50 'g' in order to attain speed comparable with the speed of light whereas in case of distances like 10 light years it is comparatively easily attainable.

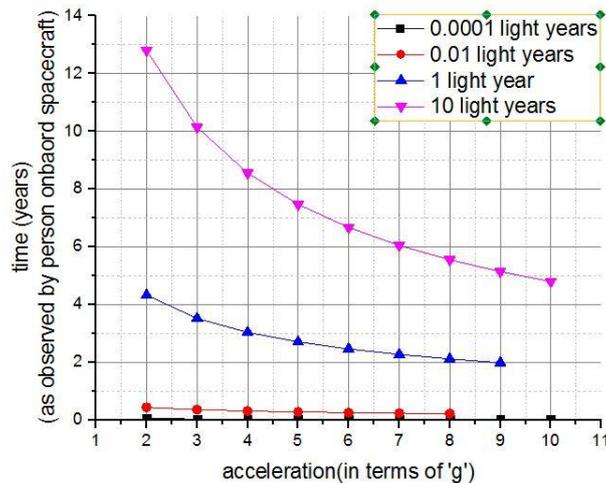


Figure 6 - Acceleration vs. Time observed

It is a notable finding that as the acceleration of the spacecraft increases the time moves slowly and the people on board are supposed to experience time move quite slowly.

### ALCUBIERRE WARP DRIVE: CYCLIC PATH

The Alcubierre approach seems to be pragmatic in terms of the technical viability, transport of matter, relatively low use of input power and its possibility without exotic matter.

It shows without violating general relativity and without the introduction of wormholes, it is possible to modify a space-time in a way that allows a spaceship to travel with an arbitrarily large speed. The basic idea can be more easily understood if we think for a moment in the inflation phase of the early Universe and consider the relative speed of separation of two moving observers. Defining this relative speed as the rate of change of spatial distance over time, we will obtain a value that is much larger than the speed of light. This doesn't mean that our observers will be travelling faster than light. The enormous speed of separation comes from the expansion of space-time itself. In the same way, one can use a contraction of space-time to approach an object at any speed. This is the basis of the model for hyper-fast space travel that creates a local distortion of space-time that will produce an expansion behind the spaceship, and an opposite contraction ahead of it. In this way, the spaceship will be pushed away from the Earth and pulled towards a distant star by space-time itself.

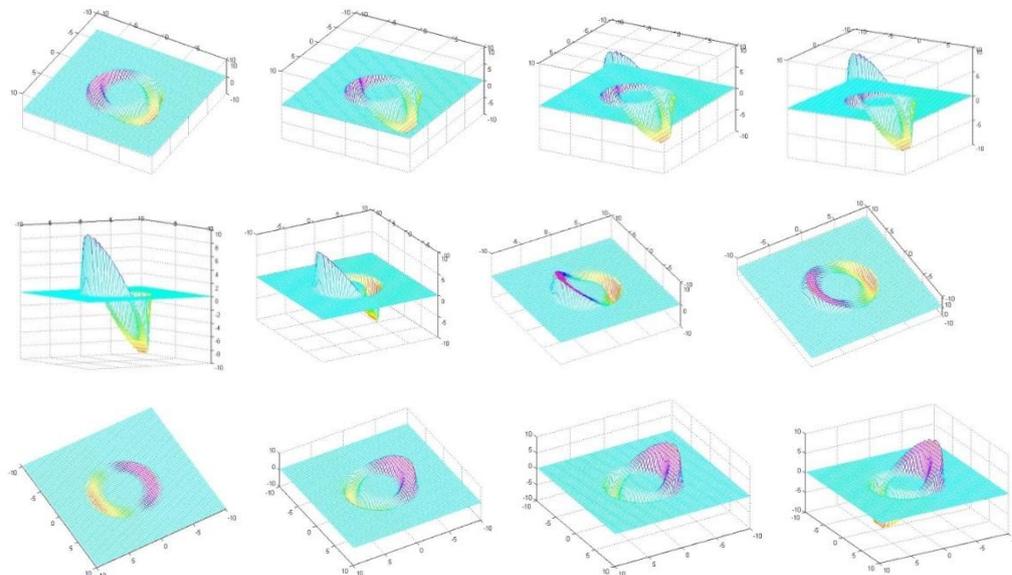


Moreover, warp drive seems technically viable as it is possible without exotic matter and also the energy required is also achievable.

A striking feature is the formation of a sphere during the expansion and contraction of the space-time continuum. The drag offered by sphere is least and the moment of inertia is  $\frac{2}{5} mr^2$ .

The warp field region has an origin of toroid which eventually gets converted to a sphere which further substantiates its speed and streamlines its path. Well not just Alcubierre, in other modes of fast travel as well, there are multiple reasons for this which consists of the aerodynamic shape and stability of sphere, its maneuverability, for same internal volume a sphere has a minimum area. Sphere has a uniform boost within and hence a uniform potential to an outside observer.

To us it corresponds to a cyclic nature. It is forming a cyclic chain in order to repeat itself. It reminds of the Indian mythology which states that there is a 'kaal chakra', i.e. anything that goes ahead can come back as well. Also there is mention in Hindu mythology that time is cyclic, which in modern day physics can be referred to as closed time like curves which forms the basis of travelling in time. After analyzing the Alcubierre effect by varying the expansion and contraction parameters and then looking at their relation with each other we came to the following conclusion which has been delineated in the following graphs. If you look at the graphs with a cursory eyes you will note that a sphere is formed here which looks like forming a cycle with time.



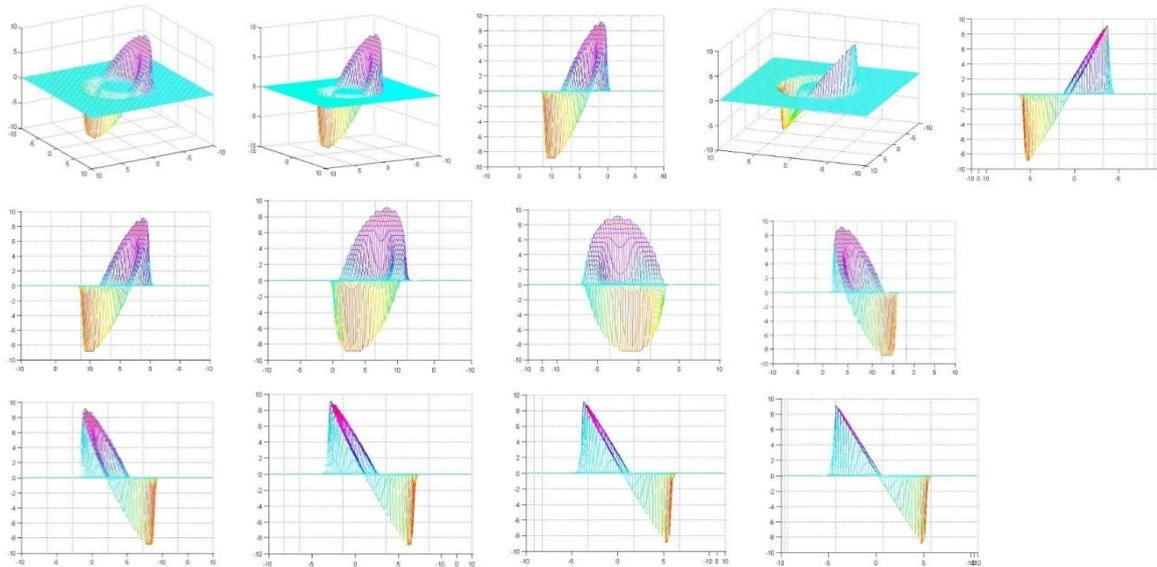


Figure 7 - Formation of closed time like curve

## HOLE TELEPORTATION AND LAWS OF PHYSICS

Among the present concepts, Hole teleportation is the sole method able to teleport matter in space and time travel because this method envelopes an object with absolutely impenetrable surface which cuts all causal and physical interactions with environment. For this reason, all other methods create paradoxes at time travel. For example, through wormholes objects from past and future can interact gravitationally due to which appear many problems with conservation laws, causality violation and so on. Also, other method Alcubierre warp drives requires negative energy which cannot be modeled by a classical space-time because geometry of negative energy density cannot be measured by local observer accurately enough to infer a negative energy density from the space-time curvature.

Hole Teleportation follows all conservation laws like mass and energy. The energy expenditure for teleportation will always be zero as it has all the properties of uniform and rectilinear motion except for time and penetration through obstacles. But the energy expenditure is necessary for curvature of space-time. In order to avoid teleportation in space we must exclude all conditions where body can reappear, this it make it travel in time.

## HUMAN TELEPORTATION: SURREAL POSSIBILITY

What if there was a way to go from one place to another without having to use any type of vehicle? A method for such a travel by combining properties of telecommunications and



transportation is called teleportation. Teleportation involves dematerializing an object (converting mass into energy) at one point, and sending the details of that object's precise atomic configuration to another location, where it will be reconstructed (conversion of energy into mass) with same memory, emotions and dreams. It means that time and space can be eliminated from travel and we could be transported to any location instantly, without actually crossing a physical distance.

Successful teleporting of a photo has been carried out. So far we have overcome the Heisenberg Uncertainty Principle, the main barrier of teleportation of objects larger than a photon. We have overcome the Heisenberg's uncertainty because we know both the speed and the position of the particle due to entanglement. In entanglement, at least three photons are needed to achieve quantum teleportation.

Though quantum teleportation does hold promise for quantum computing but using it for human teleportation seems to be farfetched at this point. It needs precise disintegration of human body and its reconstruction at another place.

Having said all this, Human teleportation does not break any law of physics and is certainly a field which requires much more attention of researchers.

### **CONCLUSION-**

The first thing that comes to our mind is that if we use different methods of time travel then we will travel at different pace and will reach same place(in future) at different times and would have aged differently in each of the technologies used though we are present in the same date in future. This somehow doesn't seem to be right.

It appears to us that we have so far not considered the biological effects of time travel (fast travel), also we have a strong opinion that going to the past is not just improbable but it violates the basic principles of logic and physics.

We think that we can use the technologies like Alcubierre in order to make fast means of commutation but time travel still seems to be a farfetched concept. We think the Indian mythology also has some great insights but it is quite difficult to comprehend.

### **FUTURE SCOPE-**

There seems to be scope in the amalgamation of the three current time travel technologies i.e. Alcubierre (which is the most pragmatic), Casimir effect (doesn't require negative



energy) and hole teleportation (this is the most practical means possible so far). The combination of the positive points of all three could lead to quite optimistic results.

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