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Answering to A Mysterious Question - "Is Time Travel Possible?"

Avik Dubey

2nd year M.E, Ramakrishna Mahato Government Engineering College, Purulia

There are some big questions concerning the whole universe: was there a beginning of time? Will there be an end? Is the universe infinite? Are there parallel universe? Does the universe contain any intelligent life beside us?

In this article I want to discuss about the nature of space and time and the possibility of time travel. Time travel has traditionally been the domain of science fiction not physics. Is it possible to build some kind of a time machine to take us back to the 1912 and see the sinking of Titanic Ship in North-Atlantic Ocean also with real "Rose"(A main character of "Titanic "movie)? Or to travel to the far future and see what technology is like in the year 7000?

Fortunately, however, at least within Einstein's theories of relativity, discussions of time travel are open to physicists as well. Before describe relativity , I 'd first like to describe the way that people thought of space and time before Einstein – the way that Isaac Newton envisioned space and time to be. First we shall talk about Newton briefly and then the crazy brilliance concept of relativity.

According to Newton, space and time were, in a sense, absolute. Space is the "stage" on which all the events of the universe happen, and time is just this thing that passes at a constant rate for all objects in the universe at all places. According to Newton, space and time exist out there independent of any objects; no object can effect space or time.

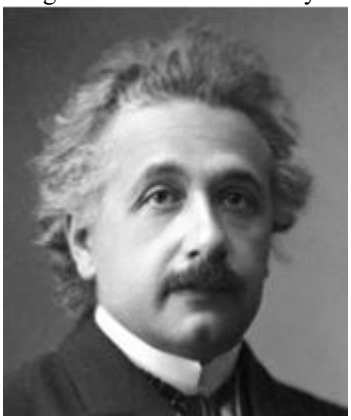
To give you a filling for absolute space and time, suppose that two- events happen- lightning strike somewhere, and then somewhere else a baby cries. And let's say you have got a watch and you time to see how long after the lightning strikes it takes for the baby to cry. In Newton's view, everybody in the universe will get the same number. If you get five seconds, then everybody else who measures it will get the same five seconds. (That's assuming, of course, that they are smart observers, i.e. that they know how to measure! A stupid observer can, of course, mess up and get a different number.) Furthermore, if you measure the distance between the two things – the lightning and the baby - you get some number, like two miles, then everybody in the universe who measures that distance will get the same thing. Space and time are absolute.

All of which in quite obvious – it should not make any difference whether I am using my watch when I am sitting down , or riding a bus , or flying a plane. Why should it? That would be Crazy!

Well -----it turns out that Nature is Crazy, because it was drawback of Newton's ideas. About 100 Years ago, people noticed that although Newton's theory works for almost every physical phenomenon that people had observe in the world, there are some things it can't explain or else has a really hard time explaining.

Fortunately, there was a smart guy who along and fixed all the mess. He was a young worker (only 25) at a German patent office, his name was Albert Einstein. In 1905, he proposed his special theory of relativity, which very -very elegantly resolved all of these problems. The theory itself is extremely simple. It has only two fundamental principles or "postulates":

1) The laws of physics are same for "everybody".
2) The speed of light is the same for "everybody".



The first postulate is very easy to accept. All it says is that Nature is fair to everybody! By "everybody", I simply mean that's moving at a constant speed.

Special relativity unifies the concepts of time and space. General relativity goes beyond unification and allows time and space to warp together in the presence of matter. General relativity even permits sufficient warping to allow "Closed time like curves". These seemingly perverse trajectories describe paths through space –time that always

move forward in local time (i.e. an observer's watch always runs forward), but eventually end up back where and when they started. A space time that contains closed time like curves, localized in one region, can be said to have a "time – machine".

Travelling forward in time is easy and does not require much new physics. In Newtonian physics, we all travel forward in time at the rate of one second per second. Special relativity allows us to travel forward in time at faster rates. Although going into the future is straightforward, we also need to go into the past- which is difficult to make a closed – time like curve. There is currently no evidence that closed time-like curves exist. For instance, we don't see future tourists coming back to visit the present. However, it is not in the tradition of physics to turn the argument around and use this lack of evidence to argue that they can't exist.

Time Dilation: Suppose it's a very beautiful summer day – like today, as you read this article and in afternoon you decide to do what you like doing best on summer-afternoon, namely, to go to the train track and watch the trains go by! So you go to the train track and you sit down on a bench. You have also brought your clock along with you, because you like to measure things with it. Now, it turns out that, according to the two postulates of special relativity, you sitting on the track will observe any clock on the train to tick slower than your clock. This effect- that moving clocks run slow – is known as "time - dilation". When you sit down and really think about these two postulates, it's simply what you find. The main fact is how much an object goes faster near the speed of light; the time- dilation is observed for that type of object, as special relativity predicts it should be.

Time travel to future: With special – relativistic time dilation under our belt, we can move on to time travel. We shall start out with time travel to the future. Obviously time travel to the future is possible. We are currently doing it – one second per second. But the question is, can we move arbitrarily far into the future of our surroundings while we ourselves age only slightly? Well, if you think about it, this time- dilation effect actually gives you a way of doing it. Here's how:

Simply find a spaceship, take off from Earth, eventually reaching a speed very close to the speed of light, and then turn around, eventually returning to Earth. Once you have returned, you shall have aged less than the people on Earth, why?

Well, let's say you are sitting on the Earth, and I leave in a spaceship. Since I am moving to you will observe time to go slower for me on spaceship. And, depending on my speed time relative to you, time can go much slower for me on the ship relative to you. So, if I adjust my speed just right , then I can arrange things so that , as 10 years passes by for me on the ship 1000 years passes by for you! I'd have to go very fast for this to happen something like 99.999 % of the speed of light – but in principle it's possible. And if I go even faster I can arrange things so that as a million years goes by for you, only a day goes by for me! So once I have returned to Earth, I shall have effectively traveled to the future.

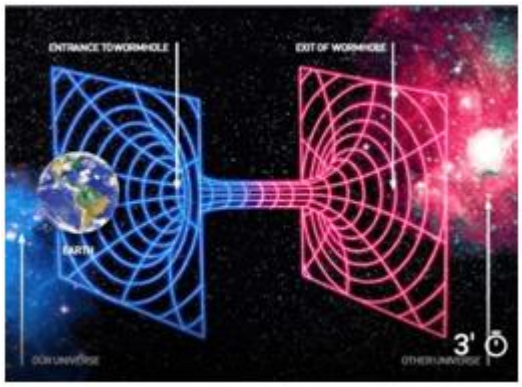
The problem, of course, is actually getting a ship to go fast enough to have a noticeable amount of time –dilation. But this is really an engineering problem, not a physics one. With today's technology, we have not even been able to get spaceships go a percent of a percent the speed of light. And here I said we need to get to 99.999% the speed of light! So with today's technology time travel to future by this method is certainly not feasible.

Time travel to the past: General relativity provides you to return in the past from future. What about time travel to the past? Well, I should mention from the starts that nobody in the world knows it's possible to travel back in time.

Before describing about time-travel in past I want to say about time control (physical time).In special theory of relativity, "Minkowski-spacetime" is 4 dimensional manifolds i.e. 3 dimensional space and 1 dimensional time. Also, time is shown to be controlled by people in Amines and other fantasy stuff, but in reality time is a dimension itself. In this world, many of us may have a desire for controlling the time (physical time). Many of us sometimes think that if time travel in past is possible then by going in past we would have corrected the mistakes we had made in the past and changed the history of our life. As an example- "Many of us may have got low marks in the exam as a student and for that reason may have faced different problems. If we have any kind of time-machine, then go to the past and pause the time of exam- hall all around us (i.e. everyone will pause except you) and gave the exams perfectly by knowing the question previously" (A thinking of school level student). Whatever happened with you in past are all histories. "History makes you what you are", says an armchair philosopher in Dexter Palmer's 2016 novel, *Version Control.* "And if you traveled back in time you would not get to be you anymore. You would have a different history and you would become someone else". Overall control the time would mean to control an entire dimension which is not possible with today's technology.

General relativity, being the bizarre theory it is , allows for the existence of very strange objects called "Wormholes" when the geometrics of space time is sufficiently funky. A wormhole is simply a path between two - places in space time. But it is not any old path between two places- it is a shortcut between them. For example, consider the star Sirius, which is approximately 54 trillion miles away. I you travelled at nearly the speed of light, it would ordinarily take about 9 years to reach it. But if the Earth and Sirius were connected by a wormhole, then it's possible for you to travel through the wormhole – which may only be 10 feet

long-and thereby reach the Andromeda Galaxy in a matter of seconds! Now here's how a hypothetical "time machine " , capable of travelling into the past , could be made out of a wormhole connecting earth and Sirius . First, (somehow) take the end, or "mouth" of the wormhole near earth, accelerate it up to a very high speed – near the speed of light and then-bring it back to Earth. As a result of the type of time dilation we discussed with the spaceship method, we then expect that the accelerated mouth of the wormhole will have aged less than the mouth of the wormhole that remained stationary near Sirius. However, it is very peculiar prediction of general relativity that this of observation is only true for observer outside the wormhole! If you were inside the wormhole, then general relativity predicts that, according to you, both mouths of the wormhole, will age just as much – they will always be synchronized, regardless of their relative motion.



Unfortunately, wormholes are highly unstable objects-meaning that very shortly after they are constructed they fall apart. However, this instability can be overcome if you have got some exotic material- matter which essentially has negative mass (!)Also, the actual construction of a wormhole appears to be rather difficult. Since, for example, a time machine might be required for the construction process. But it you can overcome these difficulties, the past is yours!

Finally, it must be said that this type of time machine only allows time travel to as far back in time as when the time machine was created. Alas, it does not like we shall be able to re-witness (through –wormhole time machines, anyway) the birth of rock roll, or Our nation's independence or Einstein's discovery of relativity – which led to all this mess!

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