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Relativity without Complexity

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Abstract: ***This manuscript uses a simple teleportation example to explain relativity with the aim to understand time travel and faster than light travel. This simple example helps in imagination and many important prediction/conclusions without resorting to complexity.***

Keywords: Relativity, Time, Space, Faster than Light, Time Travel, Lorentz Transformation factor

1. Introduction

Relativity is complex as we do not encounter it in our daily life. It is further complicated by unnatural imagination and difficult mathematics. The examples used in this manuscript reduces complexity, fosters imagination and does away with the need for complex mathematics involving speed (of light or traveler), mass and gravity. This helps in making predictions and conclusions much easier. This also clears up most of the misconceptions surrounding *relativity* and *time travel*. This makes it so easy that *relativity* can be taught even to children ages 10 and above.

2. Material and Methods

We have used teleportation to explain *relativity*. *Theory of relativity* states that time is relative and it slows down the faster we travel and when we are very near to massive objects (under gravity). Another way to say the same thing is that when clock on earth ticks 1 second, the clock with other person will tick 2 seconds or 1 minute depending on the speed of moving person or gravity, etc

Now suppose a person (time traveler) is teleported from earth to another planet and back where earth's 1 second is equal to 1 hour of the other planet. We see that when the clock on earth ticks 1 second, the clock on the other planet completes 1 hour. When the time traveler is teleported there in next second, he does not realize any difference in ticking of his time. When we teleport the time traveler back on earth in another second, we see that he has gained one hour of time (on other planet) for himself in one earth second.

Table 1: Teleportation to planet with slow time

Earth Time	Time Traveler's Time	X Planet's Time	Time Traveler's Time
12:00:00	12:00:00	12:00:00	–
12:00:01	–	13:00:00	12:00:01
12:00:02	13:00:00	14:00:00	--

Now again like in our previous example, we now teleport our time traveler to a planet where the time is moving faster by one hour, i.e. one hour of earth time is equal to one second of the other planet. When we now teleport our time traveler to the other planet and back for a period of one hour of earth time, we see that once again he does not realize that the time is moving fast or slow, only that there is mismatch in the time on his watch. We see that he has **lost one hour of earth time** in one second on the other planet.

Table 2: Teleportation to planet with fast time

Earth Time	Time Traveler's Time	X Planet's Time	Time Traveler's Time
12:00:00	12:00:00	12:00:00	–
13:00:00	–	12:00:01	13:00:01
14:00:00	13:00:02	12:00:02	--

3. Results and Discussion

3.1 We see that teleporting our time traveler is not much different than traveling by airplanes in other timezones on earth. **The time traveler only needs to reset his clock** to the other space-timezone to show correct time. And to maintain reference time of the other planet he **needs to have two clocks ticking differently** very much like we do on earth for different time zones.

3.2 In the examples above, now we increase the time dilation from 1 second of earth time equal to 10 years of the other planet. We realize that no matter what the time dilation, the time traveler is unable to go back in past. Clearly proving that **it is impossible for the time traveler to travel in past.**

3.3 Again in the above examples, we decrease the time dilation from 10 year of earth time equal to 1 second of the other planet. We realize that the Time traveler has actually traveled back on earth in future. Clearly proving that **it is possible for the time traveler to travel in future**.

3.4 Again when we refer to the examples, we realize that whether the time traveler is teleported to the other planet or earth, he always presents himself in present time of the planet and on earth. Clearly proving that **the time traveler is traveling neither in past nor in future from their point of view** but always in current moment.

3.5 From 3.2 to 3.4 above and the examples above we can state the **Laws of Time Travel** as below (which are just different perspectives):

a) Time traveler loses earth time when time is running slow at other planet, but gains earth time (on the other planet) when time is running fast (w.r.t. earth time) at the other planet. Simply saying the **Time Traveler gains or loses earth time.**

b) Time traveler can **travel into future but not in past.**

c) Wherever the time traveler goes he **will always come in the present time of earth/other planet/other spacetime.**

3.6 From the above Time Travel laws we can conclude for sure that **there are no parallel universes spliced in past, present and future** as the time traveler always reaches current/present time of the place**.**

3.7 We can also conclude from the laws of time travel that **in any system including *blackholes* or *wormholes* there is no way of going in a dimension of time where we can go back in time**. Time travel laws for time dilation will hold as above depending on speed and gravity.

3.8 Time is relative and hence speed of light is finite (or constant) in a particular spacetime. That also means **light itself is running fast or slow in different spacetime** to reach an observer in constant time.

3.9 We can also observe from above examples that there is no such thing as instantaneous. **What is instant for someone would be a very long time for another.** This also means that the teleportation example used above is not physically possible. If a human being is teleported to higher time dilation, he would reach there in many pieces over a period of time.

3.10 From 3.9 above we can also conclude that ***quantum entanglement* will either break in a time dilated system or the entangled particle would change its position over a period of time**. Though quantum and gravitational theories do not go well together, *relativity* seems to work with quantum entangled particles.

3.11 We can see in the above method that we can easily increase the time dilation from 1 second on earth to 1 minutes/1 hour/1 day/1 year/10 years or anything. But *Lorentz Transformation factor* only allows for limited time dilation between 15 minutes to one hour depending upon the units used for calculation. Beyond the speed of light or even at speed of light it is unable to calculate the time dilation and gives a figure of infinity. It is clear from above examples that

a) The **use of speed of light for determining time dilation** was based on the fact that (i) speed of light is finite and (ii) we haven't yet seen any object traveling faster than light and (iii) it is used in observer's (local) frame of reference.

b) The **use of speed of light is good for determining time dilation for only smaller speeds** but would probably be far off as the speed reaches speed of light and beyond. This would be similar to the way Newtonian physics is good enough for calculations on same spacetime like on earth.

c) There should either not be time dilation greater than that allowed by speed of light anywhere in the universe (which is unlikely) or **there should be many stellar objects that travel faster than speed of light**.

3.12 To **prove that it is possible to travel faster than light we can use the laws of time travel that we have just put together in 3.5 above**. Let us have a spaceship that travels at five times the speed of light, so that it reaches a planet 5 light years away in one year and comes back on earth covering a total distance of 10 light years. We see that the spaceship has completed that journey in two years, which would have taken 10 years if it had traveled at the speed of light. We see that,

a) At this speed, the time on spaceship would run really slow and hence would gain time. Here it **gains** eight years of time, relative to speed of light, but actual time dilation cannot be determined.

b) From spaceship's perspective, though the spaceship is traveling five times the speed of light it is **not able to reach in past on earth**.

c) From **earth's and other planet's perspective the spaceship only reaches it's present/current time.**

3.13 Again in the above example, when the spaceship is <u>traveling away from earth</u> at five times the speed of light, an observer on earth can see the spaceship only when the light from it reaches earth (which is at the speed of light). (<u>From earth's perspective</u>) **The spaceship will look as if it is traveling at or near speed of light**.

Figure 1: Spaceship traveling away at 5 times speed of light and light rays reaching earth from it

3.14 Now if we were <u>moving away from earth</u> in the above spaceship, present light will not be able to reach the spaceship. But past light already left from earth will reach the spaceship. Thus the observer will see events occurring in reverse direction. The earth will seem to rotate and revolve in reverse direction. Thus (<u>from the spaceship perspective</u>) if the spaceship accelerates away from earth at faster and faster speeds ultimately reaching speeds beyond speed of light, **earth will seem to move slower and slower** (at less than speed of light) **and then seem to stop its rotation** (at the speed of light) and **then start to move in reverse direction faster and faster** (at speeds faster than light).

3.15 Now when the above spaceship is <u>coming towards earth at faster than the speed of light</u>. We will be able to see the nearest light first then the farthest light. Thus, (<u>from earth's perspective</u>) **we will see the spaceship traveling backwards when infact it is coming at us**. Thus **there would be many stellar objects traveling faster than light, which appear to travel in reverse direction but may infact be moving in forward direction**.

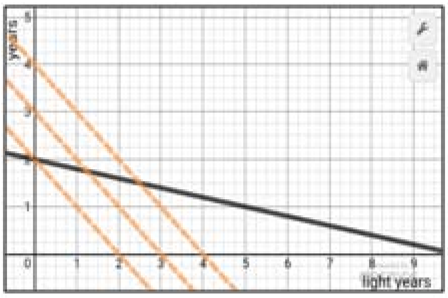

Figure 2: Spaceship traveling towards earth at 5 times speed of light and light rays reaching earth from it.

3.16 Again in above example (<u>from the spaceship perspective</u>), the traveler is already seeing a past image of earth when he begins to <u>accelerate towards earth</u>. The **earth will look as if it is rotating faster and faster in forward direction** as he will be able to see more and more current images of earth, until he reaches earth to see it's present/current moment. He will also **see earth coming towards it at or near speed of light only,** even though it is traveling at speeds faster than light. He will either see the **earth pulsating or skipped images** similar to images dancing when we rewind or forward a movie at faster speeds.

3.17 Now in above examples, when we combine both the trips of the spaceship, we see that the images of the spaceship overlap each other. We will see the same spaceship going away from us as well as coming towards us. Thus, there would be also be **some twin stellar objects that are infact one and the same**.

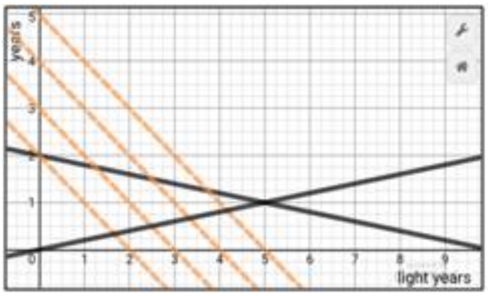

Figure 3: Spaceship traveling away and coming back to earth at 5 times speed of light and light rays reaching earth from it

3.18 From above observations we can also say that the contention that nothing can travel faster than light, should be restated as **nothing can travel faster than light from the perspective of the observer.**

3.19 From above we can conclude that **the universe is expanding based on our observation that stellar objects** (assuming there are many such faster than light stellar objects) **are moving away from us may be wrong**, as whether the object is coming at us or going away from us at speed faster than light, it would always seem traveling away from us. It would be a great setback for Big Bang Theory.

3.20 Now suppose the spaceship were to pass by the earth tangentially like a comet. Here we see that we can see the spaceship only after the light from it reaches us after it has already gone far ahead. But we will see an after image and a prior image of the spaceship at the tangent point as light from these points will reach us in equal time. From this point onwards we will see **an image of spaceship going ahead** and **an image of spaceship going back** as the light from these points will reach us at the same time. This is similar to how the predicted tachyons (particles traveling faster than light) would appear to us.

3.21 As time runs slow under gravity, there will be time dilation at the stars (and other stellar objects) and further away from these objects. Which also means that light traveling from these objects will experience different speeds at the stars and the further it travels. This phenomenon known as **Relativistic Doppler Effect or Gravitational Red Shift** can also be concluded based only on above examples.

4. Conclusion

The above examples explain relativity, time travel and many astronomical phenomenon without resorting to any mass, speed or equations. Some of the results and conclusions are already proven and some need to be reviewed against observations. But it would really help clear a lot of confusion among people regarding relativity and open up their minds and also help students enjoy the already interesting topic.

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