LIGHT SPEED CANNOT BE A UNIVERSAL CONSTANT

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ABSTRACT. That motion is relative is an accepted physical principle as everything is in motion relative to some other thing in the universe. The rule of additive relative velocity is based on this simple principle. If the speed of light as measured on the ground is c, then the velocity of light as measured by an observer moving at speed w towards the source would be $c + w$. There is no need of any experiment to confirm if indeed the speed would be $c + w$ as it is simply the speed that would result following the accepted practice of how physical measurements of distances and time are made - speed is just distance divided by time.

1. INTRODUCTION

[1] [Ver 2] Einstein's special relativity theory has the constancy of the speed of light as a postulate:

> *Postulate II: The speed of light in vacuum is a universal constant*.

This postulate is remarkable if it is true as it runs counter to our very common sense experience. What it means is that when an observer (experimenter) measures a source of light, he will get the same value irrespective of his motion. If he measures the speed of light reflected from the moon, it will always be the same universal constant speed c (customary symbol for the universal speed of light is c; 299792458 m/s) whether he is stationary on the earth or if he were to be moving at $0.5c$, half the speed of light, towards the moon - highly controversial. If the speed of light is not a universal constant, then special relativity had to be rejected. This short article shows, rather trivially, that the speed of light cannot be a universal constant.

2. SPEED IS ADDITIVE

It is intuitive that relative speed is additive. It is what we all are used to in our everyday life. If we are driving at $80k/hr$ and there is a car approaching us at $100k/hr$, then we say the relative speed

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of the approaching car with respect to ours to be $100 + 80k/hr$ - we just add the two speeds to get the relative speed. When we measure speed with respect to an observer having motion, the coordinates for measuring distance would be moving as it is constructed fixed to the moving reference observer.

The speed of light, just as with every measurement of any speed, conforms to the same rule of addition of speed. Speed is nothing but just : $speed = distance/time$. The speed formula is independent of the entity type whose speed we wish to measure. We apply the same *ruler* to measure distance covered whether the moving entity is a car, an electron or even light signals. It is the same when we use a clock to measure the time taken for the moving entity to pass through two points A,B. So, if a source of light is measured to have a speed of c relative to the ground, then for an observer that moves towards the light source with a speed of w relative to the ground, the speed of light would have a speed of $c + w$ relative to the moving observer - contrary to the postulate of special relativity. There is not any need to verify experimentally that the speed would indeed be additive and would turn out to be $c + w$. It is just a result that comes from the accepted practice of having the reference coordinate system fixed to the reference observer, whether the observer is "*stationary*" or "*moving*". In actual fact, there is no absolute rest nor absolute motion - motion is always relative. The correct convention is that the reference coordinate system is always "*constructed attached*" to the observer.

Let's have a slight detour. Say, an experiment measures the time light takes to traverse the two points from A to B on the ground; it is t sec. If there is another point C on the ground giving a line ABC where AB = BC. If we need the time light would traverse the distance BC, is it necessary that another independent experiment had to be done to determine a value? No! The answer is the same t sec and no one would argue that another independent experiment is needed. Similarly, concerning the speed of $c + w$ for light, there is no need of another independent experiment to confirm it is correct; it is how the speed would turn out to be based on how distances and time are measured with our accepted practice of measuring distances and time.

3. The Covenant of Physical Reality

Physics can be done only if there is an accepted system of physical measurement based on defined standard of units and the way physical measurements are implemented in practice. For measurements in space and time, the following are necessary:

(1) an accepted space coordinate system.
(2) an accepted mathematical representation for time.

(3) standard of units for distance - the meter.
(4) standard units for time - the second.
(5) universally synchronized clocks for all observers.
(6) accepted practice of measurement implementing the standards of (3), (4) and (5) above.

The science of physics cannot exists if any of the above conditions cannot be met and satisfied. The fact that physics is still being practice means that all of the conditions above have been satisfied - wherever the above have been put into practice.

If the above system of measurement has been satisfied, then any measurements of distance and time would be what we may call physical distance and physical time. It is the implementation of the above agreed upon system that defines what physical reality mean in physics. There is no objective absolute physical reality - if there were such a reality, it would be unknown to physics.

Physical reality in physics is found only on a covenant of physical reality.

Any purported measurements of distances and time that fall outside of an accepted practice may also be called *physical reality*, but then, if need be, we have to be careful to distinguish between different, and probably incompatible, physical realities.

4. Space Coordinate System

A means to identify positions in space is fundamental to physics. The space adopted in Newtonian mechanics is the absolute 3-dimensional Euclidean space. Before the twentieth century, this was the only mathematical space to model our physical space. No one had attempted to use any alternative space until Einstein's relativity theories which introduced Minkowski's spacetime. For more then two thousand years since the time of Euclid, Euclidean space and geometry was the only natural way to model space. The reason is simply because it is the only space that is commensurate with the innate faculties of man. Man knows the straight line. From the one dimension it could easily be extended to the 2-dimension of the plane and then to our well known 3-dimensional rectangular Cartesian coordinate system.

Anyone in the universe could set up his own Cartesian coordinates - whether he is moving and in whatever manner he is moving. With the coordinates, all of space within the universe could conceptually be measured. A car moving along the highway may set up its coordinate system and such a moving coordinates system may also be used to identify fixed positions on the ground. The method is conceptually simple - by just plain "reading off" of positions in the moving coordinates at the moment of interest in time. A method that may be conceptually simple, or even technically crude, in no way imply that the method of measurement is flawed and therefore technically invalid. How such measurements may be be made is a technical issue outside of the purview of physics theory. With our Newtonian system of physical measurement, any moving coordinate system - moving in whatever manner - may be used to identify positions fixed in any other coordinate system; it is unlike special relativity where moving coordinates system measuring positions on the ground would cause space metric distortions.

4.1. **Measuring Rods And Straightness.** In everyday life, most of us would not be concerned with standard measuring rods like a prototype for the standard length unit. The common measuring tape that we use is calibrated to give measurement in a standard unit. In Newtonian mechanics, the adopted standard of length is universal. It is valid throughout the universe. We could imagine transferring our technology to a planet in another galaxy. For a consistent standard of length, we simply bring along a standard rod; we would then be using a consistent standards in both worlds. This is theoretically correct. Our accepted space is the absolute Euclidean space - an abstract mathematical space. We set up our Cartesian coordinates here on earth. Our x-axis is a straight line. The meaning of *straight* here is the *straightness* of the Euclidean straight line - it extends straight even till the edge of the universe. So, theoretically, our lines could extend till the edge of the universe and *anyone* there could just use our calibrated line to set the same standard unit of length.

A theory of physics is independent of the way of implementing the measurement of distances (as well as time). A physics theory is based only on the abstract mathematical space adopted in which to examine physics. How distances are measured implementing the mathematical model of space is a wholly technical issue outside of the purview of the theory. If we assume that the standard meter is defined in the crude manner using a rigid rod prototype, then the possibility of measurements becoming inconsistent may be real as we may not know how traveling at speed near that of light in different regions of the universe may cause rigid rods to deform due to physics that may yet be unknown to us. If it happens, then the issue is simply one of finding an alternative to define the length standard - a technical matter that has to be resolved.

The situation in special relativity is very different. There is a theoretical length contraction. Observers moving at different speeds will *measure* a rod at rest on the ground getting different figures - unlike with Newtonian mechanics. It is a mystery how someone moving could objectively *measure* a rod at rest on the ground when the observer is far from the target rod.

4.2. **Space Neither Contracts Nor Be Curved.** The space that we started off with is the 3-dimensional Euclidean space. It is an abstract mathematical construct - meaning actually existing only as a concept in the mind. What is formed in the mind cannot be distorted or "*curved*" simply because we travel near the speed of light. A straight line of our x-axis may still be extended to the edge of the universe and it would still be as straight as ever. But putting into practice how to go along our x-axis to measure the nearest star would still be a huge challenge - a technical challenge; but there is nothing which suggest any deficiency in our theoretical framework for physics.

5. Mathematical Time, Clocks and Synchronization

The mathematical construct for time in physics is the field of real number - the simple real scalar. Whenever there is need for time measures in physics, we simply introduce the required variables $t_{0,}t_{1,}t_2$...These start off as only pure scalars without any physical units. Only through associating the variables with real physical clocks would they represent time in standard second - they become real physical measures.

Any coordinate system (observer), in whatever manner of motion, may be conceived to have coordinate clocks at every points of interest where an event is to be timed. In Newtonian mechanics, time is taken to be absolute and universal. What this means is that we have to have clocks for every coordinate frames to be all universally synchronized; such a system of universally synchronized clocks has to be a given in order that physics may be developed. But implementing such a system and the manner of making use of the clocks to measure time is again a technical issue outside of the purview of physics theory. Details on how such a system of coordinate clocks may be defined and used could be found in my other article.[1]

6. Conclusion

Contrary to the postulate of special relativity, the speed of light cannot be a universal constant. The speed of light obeys the same rule for addition of speed. The speed of the observer may be added to the speed of light to give a speed different from what is measured by a stationary observer. That the speed of light is not a universal constant unequivocally repudiates Einstein's special relativity theory.

References

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