General Relativity For Teletubbies

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Space-Time & Quantum Mechanics

"Paths in Space-Time are Imaginary"

Back to the Contents section

Abstract

It is quite clear that the Lorentz Transform Equations (LT) of Special Relativity (SR) form an extremely accurate account of observations, and there is no intent here, to cast any doubt as to the validity of the LT itself. However, it is argued here, that the attribution of the SR axioms that there is a "space-time" that objects "take a longer path in" in order to account for the observations that reunited, previously synchronised clocks read different, is a tad dubious. Such a view, conflicts with Quantum Mechanics.

SR Time

SR simply defines time "as what a clock reads", that is whatever its ticks are. Additionally, SR assumes, by the principle or Relativity, that clocks are uneffaced by any inertial motion. Thus forming a "Bible is the word of God, because it says so in the Bible that the Bible is the word of God" circular loop:

"A clock always reads the correct time, and time is what a clock reads"

Whilst from a simple experimental point of view, this is attractive, it ignores any concept as to what time is or means physically. What the nature of time is, matters, and it is this physical nature that, essentially, invalidates explanations of clock readings by declaring that the clock took a "longer path in space time".

Space-Time

"Rulers measure space, not space-time"

"Clocks measure time, not space-time"

Special Relativity accounts for the processes associated with Time, by constructing a path (line) integral. It is a mathematical construction for the following form:

$$\tau = \int f(v, x, t)dt$$

The arguments is that, just as odometers can read different from going from New York To L.A by taking different routes, clocks can read different from going from Monday to Friday by taking different routes. The integral, just expresses the "path" that the clock takes.

However, the issue for this interpretation is that there is a requirement that a construction of what time actually is, *independent of clocks*, otherwise, the phrase is simply word salad physically.

For the case of distance travelled, there are objects spread about, such that an odometer can go from point A to point B, via different routes such that the odometers can *cover more space*.

For the case of time, the only rational analogy to "covers more space" is "covers more time", that is, there is a construct for "time" such that clocks can cover more of it. For example, one can "travel" from Monday to Friday at 1 sec/sec or "travel" from Monday to Friday at say 100 secs/sec. That is, *one gets to the future*, quicker, thus experiencing less of one's own time when experiencing the events of another's time. This is, essentially, Dr. Who & his TARDIS time travel. That is, *clocks always tick the same rate according to SR*, but they cover more of this construct named "time" (space-time) to generate a lessor count of clock ticks than other observers would count on their own clocks.

This last point does not seem to be appreciated by some. There is a clear disjoint between the words "longer path in space-time" from what it must mean in reality. It is at the level of denial, for some. It is this inherent "time travel" implication of the "longer path in space-time" mode, which undermines the concept that such a notion accounts for clocks reading slow on reunion.

Real Time

A physical construct of what time measures, independent of clocks, is straight forward. It may be argued that a point in Time is simply the *physical Event* status of the system, for example, the Event state of the universe at that point. That is:

$$E_n = S_{nm}(x, p, ...)$$

Where ***n***, refers to each state of all the objects ***m*** in the universe that have a specific position ***x***, momentum ***p***, and any other relevant physical characteristic that defines a state instance.

Thus, when any single object changes its state, the state of the universe has changed, and thus so has time. If nothing changes, no clocks can change, hence time has stopped.

Thus in some manner, clock ticks are identifying when the state of the system has progressed from one state, E_n… to the next state E_{n+1}.

Longer Path in Space-Time

As noted, a "longer path in space-time" must mean that the objects traveling must cover "more of" a something named "time". From the Observer's (static) point of view, a "longer path in pace-time" means that the Observed (moving) clock is counting more states of the Observer Events, that is counting more Observer Events than that which the Observer clock counts its own states of its Events. For example:

Consider the Observed, in orbit around planet Earth. The Earth Observer will experience Events, say, $E_n, E_{n+1}, E_{n+2} \ldots\ldots E_{n+8}$. However, for the Observer to also conclude that the orbiting clock is taking "longer path in space-time" the Observe must conclude that the Observed has counted more states, say $E_n, E_{n+1}, E_{n+2} \ldots\ldots E_{n+16}$. That is, the Observed must be counting (observing) states that the Observer has yet to generate. That is, the Observer must conclude that *the Observed is counting states of the Observer's future*, states that don't yet exist for the Observer.

This is most peculiar indeed.

Thus the conclusion, as many others have written much on, is *that all futures of the universe already exist for some particular Observed*. This is referred to as the "block universe"

A fundamental issue with this conclusion is that it is in direct conflict with Quantum Mechanics. Standard Quantum Mechanics states that the universe is inherently probabilistic. It states that there is no system Event E_n such that the state E_{n+1} can be ascertained with certainty, thus there is no way, according to QM, that the Observed is able to gain knowledge of the future state of the Observer state. Thus the interpretation of "longer path in space-time" is in conflict with QM. Strict determinism also has severe problems is accounting for the ability for the conditions of this universe to be such that we can exist.

Either Standard Quantum Mechanics is false, or the interpretations of the axioms of Special Relativity are false.

The Alternative

The alternative, is to *simply take on face value the actual experimental results of reunited clocks after one clock has been subjected to a velocity profile*. That is, clocks and all physical processes do actually slow down when subject to a velocity profile with respect to another observer. One might note that it is somewhat ironic that the overwhelming common media description of Special Relativity that clocks slowdown, which is considered a false claim according to SR, is that that may well be the correct reality of the situation.

This is, arguably, the viewpoint expressed in Lee Smolin's "Time Reborn" although stated with reference to the concept of "Shape Dynamics".

The essential point being that Shape Dynamics essentially, swaps over the invariant space of GR with its variant time, to variant space with invariant time. It's essentially an expanded Lorentz contraction view of a velocity unobservable background Aether in hiding.

It's similar in idea to the equivalence of the Schrodinger Picture and the Heisenberg Picture of Quant Mechanics which swaps where time variance is accounted for from components to the basis vectors.

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