Reviving Newtonian Time to Interpret Relativistic Space-Time

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Abstract

This article presents a new interpretation of relativity whereby relativistic effects emerge as a result of rationing of Newtonian time into spatial and intrinsic motions. Unlike special theory of relativity, this theory does not need to postulate that speed of light (c) is constant for all reference frames. The constancy of speed of light emerges from more basic principles. This theory postulates that :

1. *The speed of spatial motion of a particle is always c.*
2. *Spatial motion and intrinsic motion continuously, linearly, and symmetrically rubs into each other.*

Postulate 1 seems reasonable because the Dirac model of electron already shows that the spatial speed of intrinsic degrees of freedom of an electron is always c. If the spatial speed was anything other than c then time-sharing between spatial and intrinsic motions would have entailed repeated cycles of high accelerations and deccelerations. Postulate 2 is also reasonable because it is the simplest and most symmetric way for the spatial and intrinsic time-shares to co-evolve in time. An observer's physical measure of time is entirely encoded by its intrinsic motions. This is the relativistic time. The time spent in spatial motion does not cause any change of the particle's internal state, and therefore does not contribute to measurable time.

Speed of light is constant regardless of the speed of the observer because light advances with respect the observer only for the duration of its intrinsic motion (i.e. during the relativistic time). During spatial motion, the observer moves with the light. Consequently the spatial advance of light divided by the relativistic time (i.e. the observed relative speed) is always c. Hence constancy of speed of light, which is a postulate for Einstein's relativity, is a deduced result here.

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1 Introduction

Following is the definition of time as presented by Newton in his *Philosophiae Naturalis Principia Mathematica*.

> *Absolute, true, and mathematical time, of itself, and from its own nature, flows equably without relation to anything external, and by another name is called duration: relative, apparent, and common time, is some sensible and external (whether accurate or unequable) measure of duration by the means of motion, which is commonly used instead of true time; such as an hour, a day, a month, a year.*

This absolute concept of time ruled physics for centuries until Einstein came up with his theory of relativity that viewed time not as an absolute universal but as a part of an active fabric that is sensitive to the reference frame of motion. The fundamental equations of relativity indicated that time slowed down in moving reference frames. The relativistic equations agree with experiment but has aspects that appear to lack a microscopic interpretation, some of which this article aims at addressing.

2 Derivation of the Relativistic Transform

The basic postulates of this theory are :

1. The speed of spatial motion of a particle is always c.
2. Spatial motion and intrinsic motion continuously, linearly, and symmetrically rub into each other.

To derive Lorentz transform, all we need is to express the above postulates in the language of equations.

Let us say that Newtonian time (t) is split into T and $\bar{T}$, where T is the time spent in intrinsic motions and $\bar{T}$ is the time spent in spatial motions. By postulate 1, if X denotes spatial displacement then $\bar{T} = \frac{X}{c}$.

Postulate 2 may be written in the form of the following differential equations :

$$\frac{d\bar{T}}{dt} = kT$$

$$\frac{dT}{dt} = k\bar{T}$$

Where k could be some function of t. The finite-time evolution operator (say between time t_0 and t_1) that can be obtained by solving the above set of differential equations is as follows :

$$\begin{pmatrix} cosh(\phi) & sinh(\phi) \\ sinh(\phi) & cosh(\phi) \end{pmatrix}$$

where

$$\phi = \int_{t_0}^{t_1} k(t)dt$$

Here the finite-time evolution operator may be interpreted in two ways - (1) as an operator that transforms the particle's reference frame into the observer's frame (2) as a state transition of the particle as seen by the observer.
Following are some favourable aspects of the above formulation:

1. The finite time transform (obtained on solving the differential equations) is equivalent to Lorentz transform when we define v as X/T. That is, we express the particle's frame's space coordinates in terms of the observer frame's space and time (using the inverse of the above finite-time matrix), and equate that to zero. Then the X/T we get from that equation is v which becomes equal to $c\, tanh(\phi)$. Thus if we substitute $tanh(\phi) = v/c$ in the finite-time evolution matrix, we get the exactly the Lorentz transform.

2. It is a bonus that this aforementioned equivalent of Lorentz transform applies to motion-state of particles, not just to abstract frames of reference, and the transform is not limited to inertial motion. It applies alike to accelerated motions too (with v being the average *scalar* speed during the course of the arbitrary motion).

3. The above differential equation shows that translatory motion evolves with a *symmetric* linear operator, just the way rotation (including spinor rotation) evolves with an *anti-symmetrtic* linear operator. This pattern is very satisfying and indicates a beautiful consistency.

4. The finite time evolution operator **associates** for contiguous intervals of Newtonian time (i.e. there is no preferred start point).

5. Equations of special relativity follow from it (e.g. $E = mc^2$) with an intuitive feel for why mass transforms like time intervals

3 Justifications

Following is a brief listing of reasons that suggest that the proposed theory may have some truth in it.

3.1 In support of the hypothesis that spatial speed is only ever c for all matter

Dirac's model of the electron indicates that the spatial speed of the intrinsic motion of the electron (should we say "sub-electron wisp" instead of electron because it is not the motion of the electron as a whole) is "c" (i.e. the speed of light). So it shouldn't be too surprising if the whole thing also only ever moved at c. It would be more surprising if it didn't, as that scenario would involve lots of repeated cycles of accelerations and deccelerations at wisp level.

3.2 Special Relativity as the Unusual Perfect Symmetry

We are aware that the proposed theory (at least the energization bit) violates inertial-frame symmetry which would be noticeable in the extreme cases. That might be a good thing. In the quantum world it has been observed recently (well, parity violation is not even recent) that the revered symmetries are actually only approximate. Inertial frame symmetry stood in the middle of that scene as a perfect symmetry, given the mighty geometric edifice that special relativity is. It seems only natural that the little wiggly things (that the universe is teeming with) are incapable of upholding such a perfect symmetry. The relativity of motion states may after all be an epistemic one rather than a strictly mathematical one.

3.3 Lack of Relativity of Simultaneity

In the proposed theory, relativity of simultaneity does not arise because simultaneity is not violated in the true time (Newtonian time). We think that this is a good thing. With all its symmetry construction *relativity of simultaneity* appears to be a statement in the theory without any deep justification. It appears to suggest light as a conveyer of truth without suggesting how any odd photon could convey the truth of an arbitrarily complex event (i.e. there is no information-theoretic justification that truth of events is conveyed by the wavefront moving at speec c).

3.4 Return to an underlying absolute time

It seems very intuitive that the concept of time doesn't have to be attached to an observer. The physical world may be constrained by its intrinsic motions, but imagination is not. This may be best understood by considering a time sharing computer in which the processes don't have any visibility of the global clock time. They get time slices of the computer to execute programmed code and keep track of time accrued through the time slices. The processes may not have a concept of the global system time, but that doesn't mean that the global time doesn't exist. The processes might be able to reason about the behaviour of an *always running* process to figure out the existence of a global time.