SPECIAL RELATIVITY

DEVELOPED FROM OBSERVATIONS

IN THE ETHER

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Abstract

The paper assumes the existence of an ether with quite standard properties. These assumptions are shown to produce the special relativity transformations for two dimensions each considered separately. No attempt is made to generalize the results further. Of primary importance is the insight gained into the transformations of special relativity. There is an observational and actual component to each transformation. The twin paradox is readily understood using this approach.

Introduction

The usefulness of special relativity transformations for physical measurements is well established. The physical meaning of these transformations is confusing at best. They remove the physicist one step from what he perceives as reality.

Many physicists used to believe that the transformations actually proved the nonexistense of an ether. This paper demonstrates that if an ether exists, then the special relativity transformations must exist! The converse however is not true. Thus, the special relativity transformations actually make a strong case for the existence of an ether rather than discrediting it.

The relationships in this paper are developed by making a careful distinction between apparent observations and the actual happening. It is important to discriminate between these two viewpoints in order to understand the resulting formulaes.

The following assumptions hold throughout this paper:

1. All observations are made in a stationary ether which is locally uniform and obeys the laws of Euclidean Geometry.

2. The speed of light through the stationary ether is constant and equal to c.

3. Absolute measurements and simultaneous events are measured by an observer who is stationary with respect to the ether.

4. The physical processes occurring on a body moving through the ether occur as though the rate of passage of time relative to a stationary body varies according to some function g(u) where u is the speed through the ether and $dt_U = g(u) * dt$.

5. By convention this paper assumes c is positive if the starting position of body B is greater than that of body A, and negative otherwise. This is important to note if you are trying to follow the development.

Colinear Motion along the X-axis

The following diagram depicts two bodies, A and B, moving along the X-Axis with A at uniform absolute velocity s and B at uniform absolute velocity u. The bodies were coincident at absolute time 0. The unprimed letters represent the absolute positions of the bodies when each of two different light flashes originate from A with Flash 2 starting one absolute second later than Flash 1. The single primed letters represent the absolute positions at the instant the same light flashes are received by B and instantly resent back to A. The double primed letters represent the absolute positions at the instant that A receives the return flash.

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                  s                              u
Velocity        |------>                       |--------->

Light           |---------------------------------------->|
Flash 1                             |<--------------------|

Light           |  |----------------------------------------->|
Flash 2                                |<--------------------|


Absolute        A1  A2       A1' A2'     A1" A2"    B1   B2       B1' B2'
Position        |   |        |   |       |   |      |    |        |   |
             ___|___|________|___|_______|___|______|____|________|___|___
                |   |        |   |       |   |      |    |        |   |

Absolute        A1  A2       A1' A2'     A1" A2"    B1   B2       B1' B2'
Time*        ____ ____    ____ ____   ____ ____  ____ ____    ____ ____
                s   s        s   s       s   s      u    u        u   u
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* To get system A or B local time
  multiply by g(s) or g(u), respectively

Note: the formulas on the following pages compare apparent observations from system A to actual happenings. The superscript of "a" on quantities represents the value of the quantity that is apparent to A when he does measurements.

STEP 1. Determine the apparent velocity of B as viewed by A.

Elapsed Time for Light Flash 1 to Travel to B and Back

Apparent:

$$\frac{2 * (B_1^a - A_1)}{c^a - v^a}$$

Actual:

$$\left[\frac{B_1' - A_1}{c} + \frac{B_1' - A_1'}{c + s} \right] * g(s)$$

where $B_1' - A_1 = (B_1 - A_1) * c / (c - u)$ and,

$$A_1' = A_1 + (B_1 - A_1) * s / (c - u)$$

substituting into the expression for Actual and setting equal to Apparent

$$\frac{2 * c * (B_1 - A_1)}{(c + s) * (c - u)} * g(s) = \frac{2 * (B_1^a - A_1)}{c^a - v^a} \qquad (1.)$$

Elapsed Time for Light Flash 2 to Travel to B and Back

Note: Flash 2 is one absolute second later than Flash 1.

$$\frac{2 * c * (B_1 - A_1 + u - s)}{(c + s) * (c - u)} * g(s)$$

$$= \frac{2 * (B_1^a - A_1 + v^a * g(s))}{c^a - v^a} \qquad (2.)$$

Subtract Equ. 1 from Equ. 2 and Solve for v^a

$$v^a = \frac{c * (u - s)}{c^2 - s * u} * c^a \qquad (3.)$$

STEP 2. Determine the relationship of time in system A and system B as viewed by A.

Apparent Clock Times at B_1' as Viewed by System A

System A Clock Time:

$$t_A = \frac{B_1^a - A_1}{c^a - v^a} + \frac{A_1}{s} * g(s)$$

System B Clock Time: $t_B = \theta(u,s) * t_A$

$\theta(u,s)$ is a constant when particular values of u and s are given. This constant transforms apparent system A clock time (viewed by A) into apparent system B clock time (also viewed by A) at that same apparent moment. Since the values of t, t_A, t_B and x were all zero when A and B were coincident and since g(s), g(u), u, v, and v^a are all constant when particular values of u and s are given, there exists such a constant that will correct for both actual and/or observational differences in time between systems A and B.

Actual Clock Times at B_1'

System B Clock Time:

$$B_1' * \frac{g(u)}{u}$$

where $B_1' = (B_1 - A_1) * c / (c - u) + A_1$

$= B_1 * c / (c - u) - A_1 * u / (c - u)$

Setting Actual System B Time to Apparent Time as Viewed by A

Flash 1:

$$\frac{c}{c - u} * g(u) * \left[\frac{B_1}{u} - \frac{A_1}{c} \right] = \theta(u,s) * \left[\frac{B_1^a - A_1}{c_a - v_a} + \frac{A_1}{s} * g(s) \right] \quad (4.)$$

Similarly for Flash 2:

$$\frac{c}{c - u} * g(u) * \left[\frac{B_1 + u}{u} - \frac{A_1 + s}{c} \right] \quad (5.)$$

$$= \theta(u,s) * \left[\frac{B_1^a - A_1 + v^a * g(s)}{c_a - v_a} + \frac{A_1}{s} * g(s) + g(s) \right]$$

Subtract Equ. 4 from Equ. 5

$$\frac{c - s}{c - u} * g(u) = \Theta(u,s) * g(s) * \frac{c^a}{c^a - v^a} \qquad (6.)$$

Substitute Equ. 3 into Equ. 6 and Solve for Θ(u,s)

$$\Theta(u,s) = \underbrace{\frac{c^2 - s^2}{c^2 - s * u}}_{\text{observational component of transformation}} * \underbrace{\frac{g(u)}{g(s)}}_{\text{real component of transformation}} \qquad (7.)$$

Motion of a System along the X-axis

The following diagram depicts three bodies, A, B and C, moving as a system along the X-Axis at uniform absolute velocity s. At rest the system is in equilibrium with B separated by **y** from A and C separated by **x** from A. When in motion a new equilibrium is achieved with B separated by $\mathbf{y_1}$ from A and C separated by $\mathbf{x_1}$ from A. The positions of A, B and C are chosen such that a flash of light leaving A separately to B and C which is then reflected back to A will arrive back at A from B and C simultaneously. Treat position A as the origin for simplicity.

```
 B       B'      B''       Note: C' is not simultaneous
        / \                      with B'.
       /   \
      /     \
     /       \
    /         \
   /           \
 |/             \|            |
 |_______|_______|___|_____________|_____________|______

 A       A'      A'' C             C'            C''

 |-------------------------------->|
 |                                 |
 |               |<----------------|
```

Vertical Light Component Time from A to B' and back to A''
(time measured in system A)

Apparent:

$$\frac{2 * y_1^a}{c^a}$$

Actual:

$$\frac{2 * y_1}{\sqrt{c^2 - s^2}} * g(s)$$

Setting Actual Equal to Apparent:

$$\frac{2 * y_1}{\sqrt{c^2 - s^2}} * g(s) = \frac{2 * y_1^a}{c^a} \qquad (8.)$$

Horizontal Light Component Time from A to C' and back to A''
(time measured in system A)

Apparent:

$$\frac{2 * x_1^a}{c^a}$$

Actual: use Equ. 1 with u = s

$$\frac{2 * c * x_1}{c^2 - s^2} * g(s)$$

Setting Actual Equal to Apparent:

$$\frac{2 * c * x_1}{c^2 - s^2} * g(s) = \frac{2 * x_1^a}{c^a} \qquad (9.)$$

Hypothesis of Equilibrium

A system in motion will seek an equilibrium such that each of its components will appear in the same relative position to each of the other components as before the motion with the apparent speed of light equal to c.

Applying this hypothesis to Equ. 8 and further assuming that dimensions perpendicular to the direction of motion are unaffected by the motion (i.e. $y_1 = y$), we get:

$$g(s) = \frac{\sqrt{c^2 - s^2}}{c} \qquad (10.)$$

Applying this hypothesis to Equ. 9 yields:

$$x_1 = x * \frac{\sqrt{c^2 - s^2}}{c} \qquad (11.)$$

Solve for the Transformation Factor Θ(u,s)

Substitute Equ. 10 into Equ. 7

$$\Theta(u,s) = \frac{\sqrt{c^2 - u^2} * \sqrt{c^2 - s^2}}{c^2 - u*s} \qquad (12.)$$

Thus, $\Theta(u,s) = \Theta(s,u)$ and the relativistic view holds.

Compare to the Standard Relativity Transformation, ß

$$ß = \sqrt{1 - v^{a2} / c^{a2}}$$

Substitute from Equ. 3 for v^a:

$$ß = \frac{\sqrt{c^2 - u^2} * \sqrt{c^2 - s^2}}{c^2 - u * s} \qquad (13.)$$

Equation 12 is identical to equation 13 !!!