CERN-EXT-2004-126
28 September 2004

# Preferred Frames of Reference are compatable with Relativity

By: Paul Karl Hoiland
Email: paultrr2000@yahoo.com
Transtator Industries

Abstract: It will be shown that in the case of a spatially compact universe relativity can still apply even though a preferred frame of reference must be admitted.

The following equations express the coordinates of events of one inertial observer in terms of another:

$$x' = f(v)(x - vt)$$
$$t' = g(v)t + \frac{x}{v}\left(\frac{1}{f(v)} - g(v)\right)$$

From elementary calculus we know that velocity transforms according to the following rule:

$$\frac{dx'}{dt'} = \frac{f(v)(\frac{dx}{dt} - v)}{g(v) + \frac{1}{v}(\frac{1}{f(v)} - g(v))\frac{dx}{dt}}$$

Let c be the speed of light in the rest frame $\Sigma$. Then x=ct and x=-ct implies that $x' = c_{\rightarrow} t'$ and $x' = -c_{\leftarrow} t'$ respectfully, where

$$c_{\rightarrow} = \frac{f(v)(c - v)}{g(v) + \frac{c}{v}(\frac{1}{f(v)} - g(v))}$$
$$c_{\leftarrow} = \frac{f(v)(c + v)}{g(v) - \frac{c}{v}(\frac{1}{f(v)} - g(v))}$$

Let $\tilde{t}$ be the time it takes a photon to circumnavigate the universe as measured by an observer in the absolute frame of reference. Let $\tilde{d}'$ be the distance around the universe as measured in $\Sigma'$.

Let (0, $\tilde{t}$) be the event in $\Sigma$ where two opposing photon bursts return to their place of origin. This event (the great illumination) according to the coordinates of the nearby moving frame $\Sigma'$ is (x',t') = ($-vf(v)\tilde{t}$, $g(v)\tilde{t}$). This means that the distance in $\Sigma'$ between the two coordinate origins at the time of the great illumination is the absolute value of $-vf(v)\tilde{t}$.

Note this also. When the photons arrive at x'=$-vf(v)\tilde{t}$, the two bursts are still traveling in opposite directions. To a local observer in the frame $\Sigma'$, the photons moving away from x'=0 have already been there and have traveled the distance $\tilde{d}' + vf(v)\tilde{t}$. The photons headed toward x'=0 have only traveled the distance $\tilde{d}' - vf(v)\tilde{t}$. Considering the elapsed time and position of the photons for this event, we see that

$$\underset{\rightarrow}{c}\, g(v)\tilde{t} = \tilde{d}' - vf(v)\tilde{t}$$
$$\underset{\leftarrow}{c}\, g(v)\tilde{t} = \tilde{d}' + vf(v)\tilde{t}$$

Subtract one equation from another and get

$$\underset{\leftarrow}{c} - \underset{\rightarrow}{c} = \frac{2vf(v)}{g(v)}$$

This is a constraint on the general form of our coordinate transformation:

$$\frac{f(v)(c+v)}{g(v) - \frac{c}{v}(\frac{1}{f(v)} - g(v))} - \frac{f(v)(c-v)}{g(v) + \frac{c}{v}(\frac{1}{f(v)} - g(v))} = \frac{2vf(v)}{g(v)}$$

The identity implies that $\frac{1}{f(v)} = g(v)$. This simplifies things a bit giving us as the final form of the transformation equations:

$$x' = f(v)(x - vt)$$

$$t' = t / f(v)$$

An earlier result now reads:

$$f(v)(c - v)\tilde{t} = \tilde{d}' - vf(v)\tilde{t}$$
$$f(v)(c + v)\tilde{t} = \tilde{d}' + vf(v)\tilde{t}$$

Therefore $\tilde{d}' = f(v)c\tilde{t}$

$\tilde{d} = c\tilde{t}$ is the distance around the universe in the absolute frame of reference. Therefore $\tilde{d}' = f(v)\tilde{d}$ is the distance around the universe in our moving frame.

We have assumed that the postulates of special relativity apply in the greatest extent possible. Consider now the two-way speed of light in the moving frame $\Sigma'$.

$$\underset{\rightarrow}{c} = f^2(v)(c - v)$$

$$\underset{\leftarrow}{c} = f^2(v)(c + v)$$

From a fixed point in $\Sigma'$, let a photon propagate a distance L and then return:

$$L = f^2(v)(c - v)\breve{t}$$
$$L = f^2(v)(c + v)\hat{t}$$

Let the average speed $\frac{2L}{\breve{t} + \hat{t}} = c$.

Then $$\frac{2}{\frac{1}{f^2(v)(c - v)} + \frac{1}{f^2(v)(c + v)}} = c$$

Consequently, $$f(v) = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}}$$

This admits SR for such a state. I'll write my equations with the traditional gamma:

$$x' = \gamma(v)(x - vt)$$
$$t' = t / \gamma(v)$$

We find then that relativity while still applying works differently in a spatially compact universe from normal SR. In fact, such a universe does admit to a preferred frame of reference.

An absolute frame of reference allows for motion faster than light. This is one such following generalization of Special Relativity for superluminal velocities:

$$x' = \tilde{\gamma}(v)(x - vt)$$
$$t' = t / \tilde{\gamma}(v)$$
$$\tilde{\gamma}(v) = \tilde{\gamma}(-v)$$

$$\tilde{\gamma}(v)=\gamma(v-zc) \text{ if } zc < v < (z+1)c$$

$$\gamma(v) = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}}$$

The physics of this is that z=1,2,3,… is a warp factor that indexes different states of motion. There is nothing about this transformation that violates the known laws of physics, except the acceptance of a preferred frame in the first place.

Estimation of unknown qubit elementary gates and alignment of reference frames are formally the same problem as established by modern theory. This whole q-bit idea underlines modern field theory approaches to quantum states in the first place. Thus, preference of reference frames is rather built into modern theory.

The question could now be asked does such a situation allow for something akin to an aether drift modeling. If there where such a preferred frame our own motion within such a frame should be able to be detected. This may shed some light on the old Dayton Miller Ether-Drift Experiments results. But the implication of such would be that while SR still applies, we live in a spatially compact universe.

REFERENCES

See all the following: 1922: Dayton Miller, "The Ether-Drift Experiments at Mount Wilson Solar Observatory", Physical Review, 19:407-408, April 1922.
* 1925: Dayton Miller, "Ether-Drift Experiments at Mount Wilson", Proceedings, Nat. Acad. Sciences, 11:306-314, June 1925.
* 1925: Michelson, A.A., H. Gale & F. Pearson: "The Effect of the Earth's Rotation on the Velocity of Light" (Parts I and II), Astrophysical Journal, 61:137-145, April 1925. Also see: "Letters to the Editor: The Effect of the Earth's Rotation on the Velocity of Light", Nature, 115:566, 18 April 1925.
* 1926: Dayton Miller, "Significance of the Ether-Drift Experiments of 1925 at Mount Wilson", Science, 63:433-443, 30 April 1926.
* 1927: Michelson, A.A.: Studies in Optics, U. Chicago Press, Chicago, 1927.
* 1928: Dayton Miller, untitled lecture in "Conference on the Michelson-Morley Experiment", Astrophysical Journal, LXVIII:341-402, Dec. 1928; also in Contributions From the Mount Wilson Observatory, No.373, Carnegie Institution of Washington.
* 1929: Michelson, A.A., Pease, F.G. & Pearson, F.: "Repetition of the Michelson-Morley Experiment", Nature, 123:88, 19 Jan. 1929; also in J. Optical Society of America, 18:181, 1929.
* 1930: Dayton Miller, "Ether Drift Experiments in 1929 and Other Evidences of Solar Motion", J. Royal Ast. Soc. Canada, 24:82-84, 1930.