Abstract

The Interdefinition of Length and Time

Since 1983, the meter, second and speed of light "c" have been defined by
N meters = c * 1 second with N = 299,792,458.
We find, that’s had a profound effect on Relativity Theory.

In the MKS system of units we have the basis vectors $\vec{e}^0, \vec{e}^1, \vec{e}^2, \vec{e}^3$ such that the
magnitudes are:

$$\left| \vec{e}^i \right| = \text{meter, for } i = 1, 2, 3 \text{ and } \left| \vec{e}^0 \right| = c \times 1 \text{ second}.$$ (1)

These are related by $N \times \left| \vec{e}^i \right| = \left| \vec{e}^0 \right|$ as per International definition. We may of course
eliminate the $N$ by an arbitrary change in the length scale to simplify to $\left| \vec{e}^i \right| = \left| \vec{e}^0 \right|$.

With it understood the $\vec{e}^u$ are the 4D basis vectors, we define our metrics by the
scalar products herein,

$$g_{uv} = \vec{e}_u \cdot \vec{e}_v \text{ and } g^{uv} = \vec{e}^u \cdot \vec{e}^v,$$ (2)

being the covariant and contra variant metric tensors.

In a Cartesian Coordinate System that yields,

$$g_{00} = g_{11} = g_{22} = g_{33} = 1.$$ (3)

An Alternative to the conventional Minkowski Metric.

In flat space we set $g_{00} = g_{11} = g_{22} = g_{33} = 1 \text{ and } g_{0i} = -\frac{dx^i}{dx^0},$ that and that works
well when merging SR with GR, neatly expressed,

$$U^i U_i = 0$$ (4)

as the definition the modern Theory of Relativity as required by the new
1983 definition of time.

Expand that to detail time and space as,

$$U_0 U^0 + U_i U^i = 1, \{i = 1, 2, 3\}$$ (5)
The $U,U^i$ is *absolute velocity* and since one can always find a CS where motion of something is zero, is the same as saying motion is relative, hence, $U,U^i = 0 = absolute \, motion$ is the covariant way (for all CS’s using tensors) of writing ”motion is relative”. Of course relative motion is retained by $U^i$ and being non-zero generally produces, $U_i = 0$, generally. 

(6)

Now we can use association to obtain,

$$U_i = g_{i\mu}U^\mu = 0$$

(7)

and expand index "\(\mu\)" in time and space \{0,\(i\}\} to,

$$0 = g_{i0}U^0 + g_{ij}U^j$$

(8)

Using algebra we see,

$$g_{i0} = -\frac{g_{ij}U^j}{U^0} = -\frac{g_{ij}dx^j}{dx^0}.$$ 

(9)

Specifying a flat space-time metric \(g_{ij}\) simplifies to the Kronecker delta and so, $g_{i0} = -\frac{dx^i}{cdt}$, simplified, and is aberration...a real effect well established by experiment.

Now we substitute the nonorthogonal components in \(ds^2 = g_{\nu\sigma}dx^\nu dx^\sigma\) by expanding indices "\(\mu\)" and "\(\nu\)" over time and space,

$$ds^2 = g_{00}dx^0dx^0 + 2g_{0i}dx^0dx^i + g_{ij}dx^i dx^j$$

(10)

From Equation (9) substitute in $g_{0i} = -\frac{g_{ij}dx^j}{dx^0}$ and get

$$ds^2 = g_{00}dx^0dx^0 - g_{ij}dx^i dx^j (generally),$$

(11)

substituting in a simplified metric $g_{00}g_{11}... = 1$ and $dx^0 = cdt$ to get the familiar

$$ds^2 = c^2dt^2 - dx^2 - dy^2 - dz^2$$

(12)

that Minkowski and later Einstein needed for GR.
The relative motion and the vanishing of *absolute* motion has been deduced to $U_i = 0$.

Above, we see the only metric compatible with $U_i = 0$ is,

$$ds^2 = g_{\alpha\beta} dx^\alpha dx^\beta - g_{ij} dx^i dx^j \quad \text{(generally).}$$  \hspace{1cm} (13)

Note: The $\sqrt{1}$ is not applicable or possible in time or space, (it may be mathematically possible to transform $\sqrt{-1}$ axes to normal axes).

For Conception Dynamics
Ken S. Tucker

© 2014