Vector Spaces

By "Flamenco Chuck" Keyser
BuleriaChk@aol.com

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The Relativistic Unit Circle

Vector spaces

A vector space is formed for each Lorentz rotation of the relativistic unit circle where either $m_0 = ct = 1$ (no perturbation $vt' = 0$) or $m_0' = ct' = 1$ is taken as the final state, and constitutes a dimension, where the dimension of the system is $n = n(ct)$ or $n = n(ct')$

That gives a set of positive integers $1^2, 2(1^2), 3\left(1^2\right), ..., n(1^2)$; if no integers are created at all, then $ct = 0$ or $ct' = 0$. Within the relativistic unit circle, equal and opposite integer creation rates and times yield the null vector for that dimension, where

$$\begin{vmatrix} ct & 0 \\ 0 & ct \end{vmatrix} \rightarrow (\pm ct) \otimes (\pm ct) \rightarrow (ct)^2 \left(\bar{0}\right) \text{ or } \begin{vmatrix} ct' & 0 \\ 0 & ct' \end{vmatrix} \rightarrow (\pm ct') \otimes (\pm ct') \rightarrow (ct')^2 \left(\bar{0}\right)$$

This forms the basis set $I_n = \begin{vmatrix} 1^2 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1^2 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1^2 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1^2 & 0 & 0 \\ 0 & 0 & 0 & 0 & ..... & 0 \\ 0 & 0 & 0 & 0 & 0 & 1^2 \end{vmatrix}$, where $Tr(I_n) = n(1^2)$ and

$det(I_n) = \left(1^2\right)^n$. Each dimension represented by a basis 1^2 can be multiplied by a metric length x, where the scalar $x = 0$ is taken to be the midpoint of all possible metric lengths in that dimension. Each dimension is then represented by the symbols $\vec{i}, \vec{j}, \vec{k}, ...$, so that a vector is represented by $\vec{x} = x\vec{i} = x = 0(1^2)\vec{i}$ in that dimension. For $x = 0$, there is no metric length associated with the dimension, so that if a common metric for all dimensions is assumed, the trace of the system is $n = 0$. Setting $x = 0$ for a single dimension removes that dimension from the system (a tensor "contraction), so the dimension is then $n - 1$.

This results when the "dot" product of two basis vectors are taken $\vec{i} \cdot \vec{j} = 0$. Conversely, an additional dimension is added when the "cross" product of two basis vectors is taken: $\vec{i} \otimes \vec{j} = \vec{k},\ \vec{j} \otimes \vec{i} = \left(-\vec{k}\right) = \left(\overleftarrow{k}\right)$, where the reverse arrow indicates an equal and opposite orientation of the $(\pm k) = \left(\overleftrightarrow{k}\right)$ vectors. Adding these vectors yields the "null" vector representing an equal and opposite "force" in physics):

$\left(\vec{i}\otimes\vec{j}\right)+\left(\vec{j}\otimes\vec{i}\right)=\vec{k}+\overleftarrow{k}=\left(\vec{0}\right)$, where a scalar multiple of the null vector gives the magnitude of the equal and opposite "force" $\overleftrightarrow{x}=x\left(\overleftrightarrow{0}\right)$. If $x=0$, the magnitude of this force is equal to zero, so that $\overleftrightarrow{0}=0\left(\overleftrightarrow{0}\right)$. Which is a contraction of the system; if such a vector is retained in the system, then the determinant is zero for the whole system.

If interactions $\overrightarrow{\Delta vt'}=(vt')\vec{s}$ are included in the system for the metrics represented by $(1)\left(\overrightarrow{ct}\right)=(1)\left(1^2\right)\vec{i}$, then if it is independent of the dimension, it is characterized by a second dimension $\vec{s}$ so that $\vec{c}=c(\vec{r})=c\left(\vec{i}\otimes\vec{s}\right)=c\left(\overrightarrow{k_s}\right)$ where $\vec{r}=\overrightarrow{k_s}$ is not a member of the original system, since it is not a basis vector unless explicitly included; it is therefore orthogonal to the hyperplane of the original system.

If the three vectors $\left(\overrightarrow{ct}\right)$, $\left(\overrightarrow{ct'}\right)$, and $\left(\overrightarrow{vt'}\right)$ have no common metric, then they are "affine" – i.e., their individual metrics have no common origin, or unrelated (in the case of integers, these vectors form a Pythagorean triple $\left(\vec{a},\vec{b},\vec{c}\right)$ with no common origin, and hence no common metric; in particular, there is no common null vector for the vector space.

If they have a common origin (so that the midpoints of all possible lengths in each dimension coincide, then the vector relation is given by $(ct')\vec{r}=(vt')\vec{s}+(ct)\vec{i}$. If it is understood that $\vec{r}=\vec{s}$ and $\vec{k}$ represents vectors not in the hyper plane given by $(\overrightarrow{i_n},\overrightarrow{j_n})$ the relation can then be characterized by the relation $(ct')\vec{r}=(vt')\vec{j}+(ct)\vec{i}$ This relation can also be characterized as an initial condition $\overrightarrow{ct}$, a "perturbation" $\left(\overrightarrow{vt'}\right)$ and a final condition $\left(\overrightarrow{ct'}\right)$, where $(vt')=0$ means that $\overrightarrow{ct'}=\overrightarrow{ct}$ so that $t'=t$ for the common "metric creation rate" c.

(ct') as Invariant Final Condition

The relativistic unit circle is then derived by considering the two "inputs" (ct) and (vt') in terms of the final "output" (ct'), so that dividing by the scalar (ct') yields the relation $(1)\vec{r}=\left(\frac{v}{c}\right)\vec{j}+\left(\frac{t}{t'}\right)\vec{i}=\beta\vec{i}+\gamma\vec{j}$. The magnitude of the vector $\vec{r}$ is given by the relation $1^2=r^2=\gamma^2+\beta^2$ so that $1=\sqrt{\gamma^2+\beta^2}$

For Fermat's Theorem that $n=n\left(\sqrt{\gamma^2+\beta^2}\right)$ cannot be an integer unless either $\gamma^2=0$ or $\beta^2=0$.

Since the metric relation given by the scaling factors t and t', the relation $1^2 = r^2 = \gamma^2 + \beta^2$ includes all possible relations in the vector space defined by $\vec{r}$.

Therefore, consider the relation $(r')^2 = (\gamma + \beta)^2 = \gamma^2 + \beta^2 + 2\gamma\beta = 1^2 + 2\gamma\beta$ For the relativistic unit circle, $\gamma\beta$ must be equal to zero, so that $\gamma \cdot \beta = 0$, which means that $\beta \perp \gamma$ (γ and β are orthogonal, so γ is independent of any value of β, and vice versa. This also means that the interaction $\gamma\beta$ has no common metric, so its interaction "energy" is "virtual", or imaginary. It thus can be removed from $(\gamma + \beta)^2$ by the prescription $r2 = (\gamma^2 + \beta^2) = (\gamma + i\beta)(\gamma - i\beta)$, where $i = \sqrt{-1}$

(ct) as Invariant Initial Condition

If, however, the equation $(ct')\vec{r'} = (vt')\vec{s} + (ct)\vec{i}$ is characterized by the "initial" condition ct, then $\left(\frac{t'}{t}\right)\vec{r} = \left(\frac{v}{c}\frac{t'}{t}\right)\vec{s} + (1)\vec{i}$, so that $\left(\frac{t'}{t}\right)^2 = \left(\frac{v}{c}\frac{t'}{t}\right)^2 + (1^2) = (\beta\gamma)^2 + (1^2)$ In terms of the state as the final condition, this can only be valid if $v = 0$ so that $t' = t$. However, if a second "interactive" metric is applied so that $(1') = (\gamma')^2 = (\gamma\beta) + 1^2$, then this characterizes a new "basis" for the dimension characterized by $\vec{r}$. For any integer n, if $n^2 = \gamma\beta$ so that $\gamma = 1, \beta = n$, then the new basis is given by $(1')^2 = (\gamma')^2 = (\gamma\beta) + 1^2$, so $(1')^2 = (\gamma')^2 = (n\gamma) + 1^2 = (n\gamma) + \gamma^2 = \gamma(n+1)$ Finally, if $\gamma = n$, then $(1')^2 = (\gamma')^2 = S = n(n+1)$. This new basis is then characterized as "spin", consisting of the energy of the relativistic unit circle plus the interaction energy $\gamma\beta$ for "momentum" $\beta = n$, so that $S^2 = [n(n+1)]^2$.

Note that for $\beta = 1$, $S^2 = 2 = 2(\gamma^2)$, so $S = \sqrt{2}\gamma$ This corresponds to the equal and opposite additional interaction between $\pm S$, characterized by $\begin{vmatrix} S & 0 \\ 0 & S \end{vmatrix} \to S^2(\vec{0})$

If γ has the quantized energy h, so that $\gamma = h = 1$ then for a single value of interaction energy, $S = (1') = h\sqrt{2}$, so that $\gamma' = \frac{h}{\sqrt{2}}$ For n such spins, $nS = n\gamma' = \frac{nh}{\sqrt{2}}$ in the dimension $\vec{r} = \vec{k}$, where $\vec{c'} = c^2\vec{r'} = (\gamma^2 + \beta^2) + \frac{n}{\sqrt{2}} = 1^2 + \frac{n}{\sqrt{2}}$

(For Fermat's Theorem, this means that c^2 cannot be an integer unless $n = 0$ (i.e., $\beta = 0$ for $\gamma = 1$), so $c = \sqrt{c^2}$ cannot be an integer.

If c cannot be an integer for the case $n = 2$ for either an invariant initial condition or invariant final condition (as an integer), then it can only be an integer if $vt' = 0$; i.e. $\beta = 0$

where ct and ct' have a common metric. (Again, if there is no common metric, then Pythagorean triples indicate that the vectors are affine, and the iondependent triples result from the base of the number systems as counted in either dimension – but not both).

For $n > 2$ (Fermat's Theorem)

Then c^n cannot be an integer from the Binomial Theorem, where $c^n = \left(\gamma + \beta\right)^n = \gamma^n + \beta^n + \mathrm{Re}\,m(\gamma, \beta, n) = \left(\gamma + \beta\right)^2 (\gamma + \beta)^{(n-2)}$ (where $\mathrm{Re}\,m(a,b,n)$ consists of all terms in the Binomial Expansion that are not γ^n or β^n) cannot be an integer unless either $\gamma = 0$ or $\beta = 0$, since all terms in $\mathrm{Re}\,m(\gamma,\beta,n)$ must be positive for $\gamma > 0$ and $\beta > 0$

That is, for Fermat's Theorem to be false, $\mathrm{Re}\,m(\gamma,\beta,n) = 0$ so that $c^n = \left(\gamma + \beta\right)^n$

But $\mathrm{Re}\,m(\gamma,\beta,n) > 0$ by construction, so $c^n \neq \left(\gamma + \beta\right)^n$ (even if γ and β are integers).

Q.E.D.

In addition, note that $\left(\gamma + \beta\right)^n = \left(\gamma + \beta\right)^2 (\gamma + \beta)^{(n-2)} = \gamma^n + \beta^n + 2\gamma\beta\,\mathrm{Re}\,m(\gamma, \beta, n-2)$, which shows the relation of Spin and the elements of relativistic (photon or photo-electron equivalent mass) interaction (in powers of n) to the Binomial Theorem…

Impulse Response

(TBD)