Of Clocks And Rulers

Charles Keyser

11/13/2023

Definition of a clock

The existence of a single invariant clock is represented by its period as a prime number where its minimum period is assigned the value of one:

$t := t\left(\frac{t}{t}\right) = t\left(1_t\right)$ where $\left(1_t\right)$ characterizes "one to the base t so that a single clock interval ("tick") is represented by $1 = 1(\frac{1}{1}) = 1_1$ and $1_m = 1_n \leftrightarrow m = n$. An interval of time represented by n clock ticks I then represented by the expression $\# := nt = t + t + ...t_{(n)} = \sum_{i=1}^{n} t_{(i)}$ where the single interval t is scaled (multiplied) by the number n and is also an invariant prime number since $\# = nt = (nt)\left(\frac{nt}{nt}\right)$

The expression is also valid for scaling by a positive real number c where $\#$ represents a real sum and $\# := ct = (ct)\left(\frac{ct}{ct}\right) = (ct)\left(1_{ct}\right)$.

Rational Numbers

The "count" $\#$ in the expression $\# = ct$ is a prime number, since $\left(\#\right)(\frac{\#}{\#}) = \left(ct\right)(\frac{ct}{ct})$ but the parameters c and t are not prime individually. As an example consider the "distance" expression $x = ct$ where x is interpreted as a distance, and ct is represents time t scaled by velocity c

Then $c := \frac{x}{t} = c\left(\frac{t}{t}\right) = c\left(1_t\right)$ is not prime, since $\frac{x}{t} := \left(\frac{x}{t}\right)\left(\frac{x/t}{x/t}\right) = \left(\frac{x}{t}\right)\left(\frac{xt}{xt}\right) = \frac{x^2 t}{t^2 x}$

Therefore, ratios are not prime numbers (which also applies to the derivative of calculus $y'(x) := \frac{dy}{dx} \sim \frac{\Delta y}{\Delta x}$).

A Second Clock

A second clock can be defined in the same way with $(\#') := vt' = mt'$ The **existence** of the two clocks is then characterized by the expression $\varphi(\#,\#') := (ct) + \left(vt'\right) = \left(nt\right) + \left(mt'\right)$

The Timeline

The Timeline is characterized by the existence of all possible clocks defined by their respective intervals. Each clock is defined by its position on the timeline, with each defined by its own position at $t = 0$, so that its interval is defined by its position as $(0,\#) = (0, nt) = (0, ct)$ where the position at $t = 0$ is arbitrary on the timeline ("any-when"); i.e., there is no universal time common to all clocks.

Synchronization

A time interval is synchronized with itself by self-scaling, where $(ct)^2 = (ct)^2 \leftrightarrow (ct) = \left(ct\right)$, where $(ct)^2 - (ct)^2 = 0^2 \leftrightarrow (ct) - \left(ct\right) = 0$. This expression is valid for all powers k where $(ct)^k = (ct)^k \leftrightarrow (ct) = \left(ct\right)$ (The expression $(ct)^2 = (ct)(ct)$ represents the interaction of two equal and opposite clocks ct)

In order for two different clocks to be synchronized, their positions on the timeline must be identical, so th $ct = vt' \leftrightarrow nt = mt'$ at $(0, nt) = (0, mt')$

In order for the clocks to be synchronized they must interact at their common origin.

The existence of the two separate clocks at their common origin is characterized by expression

$$\varphi(\#,\#') := (ct) + \left(vt'\right) = \left(nt\right) + \left(mt'\right)$$

The existence of the two clocks is represented by the matrix relation:

$$Tr\left|\varphi(\#,\#')\right| := Tr\begin{vmatrix} (ct) & 0 \\ 0 & \left(vt'\right) \end{vmatrix} = Tr\begin{vmatrix} \left(nt\right) & 0 \\ 0 & \left(mt'\right) \end{vmatrix}$$

Interaction

Interaction between two clocks is represented by their multiplicative product (interaction)

If $\left(ct\right)$ and $(vt') = (mt')$ do not interact, they can be represented as vectors, $\begin{vmatrix} ct \\ 0 \end{vmatrix}$ and $\begin{vmatrix} 0 \\ \left(mt'\right) \end{vmatrix}$ where tgeir components do not interact under the dot and cross product vector multiplications, so that $\overrightarrow{\begin{vmatrix} ct \\ 0 \end{vmatrix}} \cdot \overleftarrow{\begin{vmatrix} 0 \\ mt' \end{vmatrix}} = 0$ and $\overrightarrow{\begin{vmatrix} ct \\ 0 \end{vmatrix}} \otimes \overleftarrow{\begin{vmatrix} 0 \\ mt' \end{vmatrix}} = 0$

Their interaction is then represented by the expression:

$$\varphi^2 = \left[(ct)+(vt')\right]^2 = \left[(nt)+(mt')\right]^2$$
$$= \left[(ct)^2+(vt')^2\right]+\left[2(ct)(vt')\right]$$
$$= (nt)^2+(mt')^2+2(nt)(mt')$$

Identical clocks

If the clocks are identical, then the expression becomes:

$$\varphi := (ct)+(ct)$$

$$\varphi^2 = \left[(ct)+(ct)\right]^2$$
$$= \left[(ct)^2+(ct)^2\right]+\left[2(ct)(ct)\right]$$
$$= \left[(nt)^2+(nt)^2\right]+\left[2(nt)(nt)\right]$$

The existence of the two clocks is represented by the term $\left[(ct)^2+(ct)^2\right]=\left[(nt)^2+(nt)^2\right]$ and the synchronization interaction is represented by the term $\left[2(ct)(ct)\right]=2(ct)^2=2(nt)^2$

Since,

$$\left[(ct)^2+(ct)^2\right]=\left[2(ct)(ct)\right]=2(ct)^2$$
$$=\left[(nt)^2+(nt)^2\right]+\left[2(nt)(nt)\right]=2(nt)^2$$

the criterion for synchronization of two identical clocks is

$$\left[(ct)^2+(ct)^2\right]-\left[2(ct)(ct)\right]=0$$
$$\left[(nt)^2+(nt)^2\right]-\left[2(nt)(nt)\right]=0$$

Note that this is an expression of Goldbach's conjecture "Every even number is the sum of two primes" where every number is prime to its own base, so that $n+n=2n$, $n^2+n^2=2n^2$, and in general $n^p+n^p=2n^p$ for $n=n\left(\frac{n}{n}\right)=n\left(1_n\right)$

Note that the relation derived from $\varphi := (ct) + (ct)$:

$$Tr\left|\varphi^2\right| = Tr\begin{vmatrix} (ct)^2 & 0 \\ 0 & (ct)^2 \end{vmatrix} + Det\begin{vmatrix} (ct) & (ct) \\ -(ct) & (ct) \end{vmatrix} = \left[(ct)^2 + (ct)^2\right] + 2(ct)^2 = 4(ct)^2$$

which expresses the existence and interaction of two clocks is not equivalent to the "four dimensional" result:

$$Tr\begin{vmatrix} (ct) & 0 & 0 & 0 \\ 0 & (ct) & 0 & 0 \\ 0 & 0 & (ct) & 0 \\ 0 & 0 & 0 & (ct) \end{vmatrix}^2 = Tr\begin{vmatrix} (ct)^2 & 0 & 0 & 0 \\ 0 & (ct)^2 & 0 & 0 \\ 0 & 0 & (ct)^2 & 0 \\ 0 & 0 & 0 & (ct)^2 \end{vmatrix} = (ct)^2 + (ct)^2 + (ct)^2 + (ct)^2 = 4(ct)^2$$

which expresses the existence of four non-interacting clocks. This result cannot be derived from the existence relation:

$\varphi := (ct) + (ct) + (ct) + (ct)$.

Non- Identical clocks

If the clocks are not identical then

$\varphi = \left[(ct) + (vt')\right]$ so that

$$\varphi^2 = \left[(ct) + (vt')\right]^2$$
$$= \left[(ct)^2 + (vt')^2\right] + \left[2(ct)(vt')\right]$$
$$= \left[(nt)^2 + (mt')^2\right] + \left[2(nt)(mt')\right]$$

Their existence is then represented by the expression $\left[(ct)^2 + (vt')^2\right] = \left[(nt)^2 + (mt')^2\right]$ and their interaction is represented by $\left[2(ct)(vt')\right] = \left[2(nt)(mt')\right]$

However, $\left[2(ct)(vt')\right] \neq \left[2(ct)^2\right]$ and $\left[2(nt)(mt')\right] \neq 2(nt)^2$ so the clocks cannot be synchronized.

The interaction of non-interacting clocks can then be represented by the expression:

$\#(\varphi^2) = Tr\begin{vmatrix} nt & 0 \\ 0 & mt' \end{vmatrix}^2 + Det\begin{vmatrix} nt & nt \\ -mt', & mt' \end{vmatrix} = \left[(nt)^2 + (mt')^2\right] + \left[2(nt)(mt')\right]$, and similarly for (ct) and (vt').

Note that this result is represented by the proof of Fermat's Last Theorem (which is also true for multinomials):

$c^n \neq a^n + b^n$ for the case of $n \geq 2$, $c, a, b, n > 0$:

Let

$c = a + b$

Then

$c^n = [a+b]^n = \left[a^n + b^n\right] + \left[f(a,b,n)\right]$ by the Binomial Expansion

$$c^n = \left[a^n + b^n\right] \leftrightarrow \left[f(a,b,n)\right] = 0$$
$$\left[f(a,b,n)\right] \neq 0$$
$$c^n \neq \left[a^n + b^n\right] \ qed$$

Imaginary Interaction

Consider the expression

$$i := \sqrt{-1}$$

$$\psi := (ct) + i(vt') = ct + v(it')$$

$$\psi^* := (ct) - v(it')$$

$$\psi\psi^* = (ct)^2 + (ct)[v(it')] - (ct)[v(it')] - (i)^2 (vt')^2 =$$

$$(ct)^2 + (vt')^2$$

If the equality $(ct')^2 = \psi\psi^*$ is imposed, the expression becomes

$(ct')^2 = (ct)^2 + (vt')^2$, where the Special Relativity "Time Dilation" equation is obtained by solving for t':

$$t' = t(\Gamma), \Gamma = \frac{1}{\sqrt{1-\beta^2}}, \ \beta = \frac{v}{c}$$

(However, note that if there are no negative numbers, there are no square roots of negative numbers so that $(ct) = (ct') \leftrightarrow t = t'$).

Rulers

Note that a similar analysis for $x := ct,\ x' := vt'$

In "radial" coordinates:

$$r = r_0 + r'$$
$$r^2 = [r_0 + r']^2 = \left[(r_0)^2 + (r')^2\right] + 2(r_0)(r')$$
$$\pi r^2 = \pi\left[(r_0)^2 + (r')^2\right] + (r_0)\left[2\pi(r')\right]$$

Note that the "interaction term":

$(r_0)\left[2\pi(r')\right] = (r_0)\left[C_{r'}\right]$ is the product of an (initial state) radius and a circumference.

This result can then be expanded to multinomials, but I don't have the spacetime to write it here.

Suffice it to say that for the "Big Bang" the radii of curvature of all "surfaces" (including infinitesimal gradients): must meet at a common origin. Now go calculate….