Russell's Paradox, Relativity, and Classical Physics

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(Russell's paradox and its relation to Physics, Foundations of Mathematics, Electrodynamics, Quantum FieldTheory, Fermat's Theorem, and the G.U.T)

The Relativistic Unit Circle

A barber in a village shaves all those and only those that don't shave themselves. Does the barber shave himself?" – Russell's Paradox (Bertrand Russell; 1901).

The answer to the paradox is that the barber cannot exist. A barber cannot both shave himself and not shave himself (cannot both belong to a set $\{o\}$ and not belong to the set $\{o\}$.

This is more clearly expressed by the expression "A number cannot both multiply itself and not multiply itself"; that is, $1^2 \neq 1$.

Consider the case of a unit force in one dimension $f := 1$, which is an expression of existence in an otherwise empty universe $f + 0 = f$ (Perhaps between galaxies where, for a moment, there is no CBR). For Newton's Third Law, the expression of an equal and opposite force is $\phi = f^2$

However, even for self-multiplication, two elements must exist. This is represented by the "count" matrix:\

$|\#| = \begin{vmatrix} f & 0 \\ 0 & f \end{vmatrix}$ where $Tr|\#| = f + f$ and $Det|\#| = f^2$

Note that the component by component multiplication fo the two vectors $\begin{vmatrix} f \\ 0 \end{vmatrix}$ and $\begin{vmatrix} 0 \\ f \end{vmatrix}$ results in the null vector $\begin{vmatrix} 0 \\ 0 \end{vmatrix}$ and that $\begin{vmatrix} f & 0 \\ 0 & f \end{vmatrix}\begin{vmatrix} 1 \\ 0 \end{vmatrix} = \begin{vmatrix} f \\ 0 \end{vmatrix}, \begin{vmatrix} f & 0 \\ 0 & f \end{vmatrix}\begin{vmatrix} 0 \\ 1 \end{vmatrix} = \begin{vmatrix} 0 \\ f \end{vmatrix}$ where the two vectors $\begin{vmatrix} 1 \\ 0 \end{vmatrix}$ and $\begin{vmatrix} 0 \\ 1 \end{vmatrix}$ are characterized as “up” and “down” “Spin” in Quantum Field Theory.

For Self- Interaction the expression is then $\#^2 = (f+f)^2 = [f^2 + f^2] + 2(f)(f)$ where $[f^2 + f^2]$ is the "existence" term for the two forces, and the “interaction” (multiplication) term is $2(f)(f) = 2(f^2)$

The matrix expression of this relation is:

$$\#^2 = Tr\begin{vmatrix} f^2 & 0 \\ 0 & f^2 \end{vmatrix} + Det\begin{vmatrix} f & f \\ -f & f \end{vmatrix}$$

Note that the 2D matrix $\begin{vmatrix} f & 0 \\ 0 & f \end{vmatrix}$ characterizes the existence of two unit forces, and the matrix $Tr\begin{vmatrix} 1 & 0 \\ 0 & -1 \end{vmatrix} = 0$ indicates that $1-1=0$; i.e. $1=1$ (the two forces are equal.

Existence Matrix

$$Tr\begin{vmatrix} f^2 & 0 \\ 0 & f^2 \end{vmatrix} = f^2 + f^2 = 2f^2, \; Det\begin{vmatrix} f^2 & 0 \\ 0 & f^2 \end{vmatrix} = f^4$$

Decomposition of the interaction matrix results in:

$$\begin{vmatrix} f & f \\ -f & f \end{vmatrix} = \begin{vmatrix} f & 0 \\ 0 & f \end{vmatrix} + \begin{vmatrix} 0 & f \\ -f & 0 \end{vmatrix}$$

$$Tr\begin{vmatrix} f & 0 \\ 0 & f \end{vmatrix} = f + f = 2f, \; Det\begin{vmatrix} f & 0 \\ 0 & f \end{vmatrix} = f^2$$

$$Tr\begin{vmatrix} 0 & f \\ -f & 0 \end{vmatrix} = 0, \; Det\begin{vmatrix} 0 & f \\ -f & 0 \end{vmatrix} = f^2$$

Note that the matrix $\sigma_3 := \begin{vmatrix} 1 & 0 \\ 0 & -1 \end{vmatrix}$ is often characterized as one of the Pauli Matrices, which is

$$|\sigma_3| := \begin{vmatrix} \sqrt{1} & 0 \\ 0 & i \end{vmatrix}^2 = \begin{vmatrix} 1 & 0 \\ 0 & -1 \end{vmatrix}.$$

Note that $Tr\begin{vmatrix} f^2 & 0 & 0 & 0 \\ 0 & f^2 & 0 & 0 \\ 0 & 0 & f^2 & 0 \\ 0 & 0 & 0 & f^2 \end{vmatrix} = 4f^2$ is not equivalent to $|\#^2| = [f^2 + f^2] + 2f^2$ since it doesn't include the existence of the second interacting (self-force) $f + f = 2f$ in each dimension.

Note that contemporary physics is often characterized by the **Hilbert space** (Wikipedia), which in turn represents the "dot" product (in the above case $\overrightarrow{f} \bullet \overleftarrow{f} := f^2$ and likewise omits the existence of the second force required for self-multiplication. Similarly, the cross product $\begin{vmatrix} f & 0 & 0 \\ 0 & f & 0 \\ 0 & 0 & 0 \end{vmatrix} \otimes \begin{vmatrix} f & 0 & 0 \\ 0 & f & 0 \\ 0 & 0 & 0 \end{vmatrix} := \begin{vmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & f^2 \end{vmatrix}$ also omits the existence of the second force required for self-multiplication.

For physics, the result of an equal and opposite force characterizes "Rest" mass $m_0 := \#^2 := (c\tau)^2$

If the second force is not equal, the expression becomes

$$\# = f + f' := (c\tau) + (v\tau')$$
$$\#^2 = (c\tau')^2 = \left[(c\tau)^2 + (v\tau')^2\right] + \left[2(c\tau)(v\tau')\right]$$

Where $\left[2(c\tau)(v\tau')\right]$ is the interaction term.

Curvature

For "curvature" (radial coordinates):

$$\# = f + f' := (c\tau) + (v\tau')$$
$$\pi\#^2 = \pi(c\tau')^2 = \left[\pi(c\tau)^2 + \pi(v\tau')^2\right] + \left[(c\tau)\{2\pi(v\tau')\}\right]$$

Where the existence term characterizes the {"energy" areas of two disks, and the interaction term is the product of a radius and a circumference:

$$\left[(c\tau)\{2\pi(v\tau')\}\right] = rC, r := (c\tau), C := 2\pi(v\tau') = 2\pi r'$$

Special Theory of Relativity

(Note that

$$i = \sqrt{-1}$$
$$i^2 = \left(\sqrt{-1}\right)^2 = \left(\sqrt{-1}\right)\left(\sqrt{-1}\right) = \sqrt{(-1)(-1)} = \sqrt{1^2} = 1 \neq 1$$
)

The "Time Dilation" equation can be derived by solving the equation

$(ct')^2 = (ct)^2 + (vt')^2$ which requires that the first order expression be complex:

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

Note that $(ct')^2 \neq (ct)(ct)^*$

That is, the interaction (multiplicative) term $2(c\tau)(v\tau')$ has been omitted from the expression $(ct')^2 = (ct)^2 + (vt')^2$ used to solve for "time dilation. In fact, the expression $\beta = \frac{v}{c} = \frac{f(m)}{f(m)}\beta$ is valid for all possible expressions of mass (which is why the trace of the relativistic Electromagnetic Field Tensor is zero, but the determinant is invariant for any value of $f(m)$ at position $(0,0)$ where its trace is $f(m)$

For further analysis, see:

Planck's constant, Neutrinos and Spin

With reference to the above document

Consider the identity matrix for forces, where $f = 1$:

$$|I| := \begin{vmatrix} 1 & 0 \\ 0 & 1 \end{vmatrix} = \begin{vmatrix} f & 0 \\ 0 & f \end{vmatrix}$$

The matrix expression of the interaction equation

$$\# = f + f$$
$$\#^2 = m_f = (f+f)^2 = [f^2 + f^2] + 2(f)(f)$$ is:

$$\#^2 = Tr\begin{vmatrix} f^2 & 0 \\ 0 & f^2 \end{vmatrix} + Det\begin{vmatrix} f & f \\ -f & f \end{vmatrix}$$

Note that for

$$\# = \sqrt{f} + \sqrt{f}$$
$$\#^2 = m_f = (\sqrt{f} + \sqrt{f})^2 = [\left(\sqrt{f}\right)^2 + \left(\sqrt{f}\right)^2] + 2(\sqrt{f})(\sqrt{f})$$
$$= [f + f] + [2\left(f\right)\left(f\right)] = [f + f] + [2f]$$

In the context of Electromagnetism

$$\varphi = E + B$$
$$\varphi^2 = \left[E + B\right]^2 = \left[E^2 + B^2\right] + \left[2EB\right]$$

Revised Lorentz force;

$$f = mA = q\left[\varepsilon_0 E + \mu_0 B\right]$$
$$f^2 = (mA)^2 = \left\{q\left[\varepsilon_0 E + \mu_0 B\right]\right\}^2 = q^2\left[\varepsilon_0 E + \mu_0 B\right]^2$$
$$\left[\varepsilon_0 E + \mu_0 B\right]^2 = \left[\left(\varepsilon_0 E\right)^2 + \left(\mu_0 B\right)^2\right] + 2\left(\varepsilon_0 E\right)\left(\mu_0 B\right)$$

$$2\left(\varepsilon_0 E\right)\left(\mu_0 B\right) = \left(\varepsilon_0 \mu_0\right) EB = \frac{1}{\left(c\tau_0\right)^2}\left(EB\right) = \left(\frac{1}{r_0}\right)^2, \ \tau_0 = 1, r_0 := \left(c\tau_0\right)$$

For $\tau' > 1$, $\frac{1}{\left(c\tau'\right)^2} := \frac{1}{\left(r'\right)^2}$ and the interaction becomes an decreasing function of distance as an inverse square law $\frac{1}{\left(r'\right)^2}$.

Imaginary Numbers

$$(i)(i)=\left(\sqrt{-1}\right)\left(\sqrt{-1}\right)=\sqrt{(-1)(-1)}$$
$$(-1)(-1)=(1)(1)=1^2$$
$$\sqrt{(-1)(-1)}=\sqrt{1^2}=1$$

There is no such thing as imaginary numbers in the real positive numbers (since there are no negative numbers).

From the Pauli Matrices

$$|\sigma_2|:=\begin{vmatrix}0 & -i\\ i & 0\end{vmatrix}, Det|\sigma_2|=1=f$$
$$|\sigma_2|^2=\begin{vmatrix}0 & 1\\ -1 & 0\end{vmatrix}, Det|\sigma_2|=1^2=f^2$$

Note that.

$$Det\begin{vmatrix}1 & 1\\ -1 & 1\end{vmatrix}=Det\left\{\begin{vmatrix}1 & 0\\ 0 & 1\end{vmatrix}+\begin{vmatrix}0 & 1\\ -1 & 0\end{vmatrix}\right\}$$

Note that the equivalent matrix to $\begin{vmatrix}0 & 1\\ -1 & 0\end{vmatrix}$ is the matrix $|\sigma_2|:=\begin{vmatrix}0 & -i\\ i & 0\end{vmatrix}$ and that the identity matrix is not included in the Pauli matrices defining SU(2); i.e., $Tr|\sigma_2|=0$

However, $|\sigma_2|^2:=\begin{vmatrix}1 & 0\\ 0 & 1\end{vmatrix}$ provides the real identity matrix in first order while omitting the matrix $|\sigma_2|$

Note that $|\sigma_2|^4:=\begin{vmatrix}1^2 & 0\\ 0 & 1^2\end{vmatrix}$, $Tr|\sigma_2|^4=\left[1^2+1^2\right]$ which is the existence term of the interaction representation.

Thus the process has gained “something” (the existence of forces in vacuo from “nothing” (no forces in the vacuo).

Electromagnetism

In the context of electromagnetism,

$$|\sigma_2| := \begin{vmatrix} 0 & -i \\ i & 0 \end{vmatrix} = \begin{vmatrix} 0 & -B \\ B & 0 \end{vmatrix}$$

$$|\sigma_2|^2 := \begin{vmatrix} B & 0 \\ 0 & B \end{vmatrix}, \; Tr|\sigma_2|^2 = 2B$$

$$|\sigma_2|^4 := \begin{vmatrix} B^2 & 0 \\ 0 & B^2 \end{vmatrix}, \; Tr|\sigma_2|^4 = 2B^2$$

Quarks (added 4/12/2023)