Pauli Forces

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

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 $|\sigma_2|$

$Tr|\sigma_2|^2:=\begin{vmatrix}1 & 0\\ 0 & 1\end{vmatrix}=2,\ Det|\sigma_2|^2=1^2=\frac{1}{2}(2)(1^2)$ where $(2)(1^2)$ is the interaction term.

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” from “nothing”.

In the context of electromagnetism,

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

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

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