Proof of Fermat's Conjecture for Multinomials

(and other topics in Foundations of Mathematical Physics)

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(my take on Relativity and other topics)

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The Relativistic Unit Circle (RUC)

Synopsis

This paper is a discussion relating relativity, quantum mechanics, and classical physics to their underlying mathematical foundation from the following perspective:

Particles (quarks, galaxies) interact or do not.

Consider a set of n particles represented by the matrix $|M| := |n \times n|$.

1. If the particles exist but do not interact then then $|M|$ represents the set as a diagonal $|n \times n|$ (multivalued) matrix whose elements characterize mass as the final state of two equal and opposite forces: $m = f^2$ (Example: Identity matrix)
2. If the partocles do not exist but interact, they are represented by $|M|$ where $Tr|M| = 0$. Example: Electromagnetic Field Tensor, Pauli Matrices (σ_1 and σ_2)
3. It the particles exist, but the interaction is imaginary (i.e., complex) then $|M|$ is complex.
4. If the particles exist and interact, the representation is characterized by the Multinomial Expansion set equal to a single value $\#^n = Tr|M|^n + Det\left(|M|^n\right)$ Examples: (Jacobian Matrix, Einstein Gravitational Field Tensors), Foch Space, Multinomial Expansion set to a single power $\#^n$

The discussion includes the proofs of Fermat's Conjecture (both for two particles and many particles), proof of Goldbach's conjecture, a clarification of Russell's Paradox, Special Relativity, Quantum Mechanics, and many other topics relevant to the subject.

Discussion

An empty Universe without an origin $\{0\} := 0$ is called the "**null**" set.

The existence of a number $\{a\} := a$ defines an **origin** where $a+0=a$

The existence of a second number defines a **length** (a subtraction, difference) $b-a$; for $b=a$ the expression of the origin is $(b-a)=(a-a)=0$

All numbers are positive; $a \geq 0$.

$$-c = a-b,\ b > a$$
$$b-c = a > 0$$
$$a-a = 0$$

Addition (Existence)

The existence of multiple numbers is represented by the group operator "$+$"addition, where:

$$\sum_{i=1}^{n} a_i = a_1 + a_2 + \cdots a_n$$

Note that at least one number must exist if the Universe is not the null set.

Multiplication (Change)

The multiplication of two numbers ab Is represents change by juxtaposition where

$$\prod_{i,j=1 to n}^{n} a^i b^j$$

Note that both numbers must exist for multiplication to be defined.

Self-multiplication of an existing number a to the power n is represented by the expression

$$a^n = \prod_{i=1}^{n} a^i$$

Proof of Goldbach's conjecture

Every number n is prime to its own base

$$\left(1_n\right) := \left(\frac{n}{n}\right)$$
$$\left(1_n\right) = \left(1_m\right) \leftrightarrow m = n$$
$$n = n\left(\frac{n}{n}\right) = n\left(1_n\right)$$

$$1_{f(x_1, x_2, \cdots, x_n)} := \frac{f(x_1, x_2, \cdots, x_n)}{f(x_1, x_2, \cdots, x_n)}$$

"Every even number is the sum of two primes." (Goldbach's Conjecture)

$n + n = 2n$ QED

n is odd, $n+1$ is even

$$n + n \in \{e\}$$
$$n \in \{o\}$$
$$\mathbb{R} = \{e\} \cup \{o\} \equiv \{o\}$$

Continuity

$$\{e\} = \{o\} + 1$$
$$\lim_{\{o,e\}\to\infty} \{o\}\{e\} = \{e^2\} = \{o^2\}$$
$$\lim_{n\to\infty} (n)(n+1) = n^2$$

Imaginary Numbers

Imaginary numbers (e.g. $i = \sqrt{-1}$) **do not exist**.

$$\sqrt{-1} = \sqrt{1-2}$$
$$\left(\sqrt{-1}\right)^2 = \left(\sqrt{1-2}\right)^2$$
$$-1 = 1 - 2$$
$$2 - 1 = 1$$
$$1 - 1 = 0$$

(Imaginary numbers are complex only for those who think they are somehow real."

Russell's Paradox

"A barber in a village shaves all those and only those that don't shave themselves. Does the barber shave himself?"

This paradox is often quoted as a justification for set theory, but I maintain it is an expression of the relation $(1_x)^2 \neq (1_x)$ where $(1_x) := \left(\frac{x}{x}\right)$

(That is, the barber does not exist).

$$
\begin{aligned}
&f(x) = x^2 - x = x(x-1) \\
&x = 1 \\
&x(1-1) = 0 \\
&x = 0 \\
&1 \neq 0
\end{aligned}
$$

That is, $1 = 0$ cannot exist

$$(1_x)^2 := \left(\frac{x}{x}\right)^2 \neq (1_x) = \left(\frac{x}{x}\right)$$

That is, a barber cannot both shave himself and not shave himself (the rest of the village is irrelevant).

This translates to the proposition "A number cannot both multiply itself and not multiply itself; any other dimension ("village") is irrelevant.

(Proof of Fermat's Conjecture)

Hypothesis

$(\#)^n := c^n \neq a^n + b^n, (a,b,\#) > 0, n > 1$ (Fermat's Conjecture)

Thesis (Proof)

Binomial Theorem

$\# := c = a + b$

$(\#)^n = c^n = (a+b)^n = \sum_{k=0}^{n} \binom{n}{k} a^{n-k} b^k = \sum_{k=0}^{n} \binom{n}{k} a^k b^{n-k}$ (Binomial Theorem)

$$c^n = (a^n + b^n) + \left(\sum_{k=0}^{n} \binom{n}{k} a^{n-k} b^k - (a^n + b^n) \right)$$

$$c^n = (a^n + b^n) \leftrightarrow \left(\sum_{k=0}^{n} \binom{n}{k} a^{n-k} b^k - (a^n + b^n) \right) = 0$$

Note that the products $a^{n-k} b^k > 0$

$$\left(\sum_{k=0}^{n} \binom{n}{k} a^{n-k} b^k - (a^n + b^n) \right) \neq 0$$

$$(\#)^n = c^n \neq (a^n + b^n)$$

QED

Example Case $n = 2$

$\# := c$ is the count of elements of the sets $\{a\}$ and $\{b\}$

$$c = a + b$$
$$c^2 = [a^2 + b^2] + [2ab]$$

Here $[a^2 + b^2]$ represents existence and $h^2 := [2ab] = 2S$ represents interaction (Entanglement) where h^2 is Planck's constant and S is "Spin"

Note that $\pi c^2 = [\pi a^2 + \pi b^2] + a[2\pi b]$ where a is a "radius" and $[2\pi b]$ is a "circumference, loop"

Note that $2ab = a\left(\frac{d(b^2)}{db}\right)$, which is a procedure that can be carried out to calculate the coefficients for both the binomial and multinomial expansions. This may be a simple case of Noether's Theorem

Vector

$$|M| := (4,3) = \begin{vmatrix} 4 & 0 \\ 0 & 3 \end{vmatrix}$$
$$|M|^2 = (4,3)^2 = (16,9) = \begin{vmatrix} 16 & 0 \\ 0 & 9 \end{vmatrix}$$
$$Tr|M|^2 = 25$$

Real Number

$$7 = 4 + 3$$
$$7^2 = (4+3)^2 = [4^2 + 3^2] + [2(3)(4)]$$
$$49 = [16+9] + [12] = [25] + [12]$$

Complex Number (imaginary number $i = \sqrt{-1}$)

$$\psi = (4 + 3i)$$
$$\psi^* = (4 - 3i)$$
$$\psi\psi^* = (4+3i)(4-3i) = (4)^2 + i(3)(4) - i(3)(4) - i^2(3)^2$$
$$\psi\psi^* = [16] + [9] = 25 \leftrightarrow i = \sqrt{-1}$$
$$49 = [\psi\psi^*] + [24] = [25] + [24] \leftrightarrow [\psi\psi^*] = [25]$$

[Wiles Proof of Fermat's Last Theorem]

[Modular Functions]

Since Dr. Wiles proof depends on modular forms/functions defined on the upper half of the complex plane, and imaginary numbers do not exist, the proof is moot.

Fermat's Conjecture for multinomials

Multinomial Theorem (Wikipedia)

Hypothesis (Fermat's Conjecture for multinomials)

$$(\#) := (x_1) + (x_2) + \cdots + (x_m) = \sum_{i=1}^{m} (x_i)$$

$$(\#)^n \neq (x_1)^n + (x_2)^n + \cdots + (x_m)^n$$

For a diagonal $m \times m$ matrix (vectors)

$$\left|(x_1)^n, (x_2)^n, \cdots, (x_m)^n\right| = \left|(x_1), (x_2), \cdots, (x_m)\right|^n$$

$$|X_m| = \begin{vmatrix} x_1 & 0 & 0 & 0 \\ 0 & x_2 & 0 & 0 \\ 0 & 0 & \cdots & 0 \\ 0 & 0 & 0 & x_m \end{vmatrix}$$

$$|X_m|^n = \begin{vmatrix} (x_1) & 0 & 0 & 0 \\ 0 & (x_2) & 0 & 0 \\ 0 & 0 & \cdots & 0 \\ 0 & 0 & 0 & (x_m) \end{vmatrix}^n = \begin{vmatrix} (x_1)^n & 0 & 0 & 0 \\ 0 & (x_2)^n & 0 & 0 \\ 0 & 0 & \cdots & 0 \\ 0 & 0 & 0 & (x_m)^n \end{vmatrix}$$

$$Tr\left(\|X_m\|^n\right) = (x_1)^n + (x_2)^n + \cdots + (x_m)^n$$

(Hypothesis again)

$$(\#)^n \neq Tr\left|X_m\right|$$

Thesis (Proof)

$$(\#_m)^n = \left\{\left[\sum_{k_1+k_1+\cdots k_m=n;k_1,k_2\cdots k_{m\geq 0}} \binom{n}{k1,k2,\cdots.k_m} \prod_{t=1}^{m} x_t^{k_t}\right]\right\}$$

$$= \left\{\sum_{i=1}^{m}(x_i)^n\right\} + \left\{\left[\sum_{k_1+k_1+\cdots k_m=n;k_1,k_2\cdots k_{m\geq 0}} \binom{n}{k1,k2,\cdots.k_m} \prod_{t=1}^{m} x_t^{k_t}\right] - \left\{\sum_{i=1}^{m}(x_i)^n\right\}\right\}$$

where $\binom{n}{k1,k2,\cdots,k_m} = \frac{n!}{k_1!k_2!\cdots k_m!}$

Note that the products $\prod_{t=1}^{m} x_t^{k_t} > 0$

$$(\#_m)^n = \left\{\sum_{i=1}^{m}(x_i)^n\right\} \leftrightarrow \left\{\left[\sum_{k_1+k_1+\cdots k_m=n;k_1,k_2\cdots k_{m\geq 0}} \binom{n}{k1,k2,\cdots.k_m} \prod_{t=1}^{m} x_t^{k_t}\right] - \left\{\sum_{i=1}^{m} x_i\right\}\right\} = 0$$

$$\left\{\left[\sum_{k_1+k_1+\cdots k_m=n;k_1,k_2\cdots k_{m\geq 0}} \binom{n}{k1,k2,\cdots.k_m} \prod_{t=1}^{m} x_t^{k_t}\right] - \left\{\sum_{i=1}^{m} x_i\right\}\right\} \neq 0$$

$$\therefore (\#_m)^n \neq \left\{\sum_{i=1}^{m}(x_i)^n\right\}$$

QED

Interaction (Entanglement)

Initial State (force)

$$f_0 = (ct)$$

An equal and opposite interacting force defines mass

$$\left(f_0\right)^2 = (ct)^2 = m_0$$

Perturbing State

$$f' := (vt)'$$

Resulting State

$$\# := f_\# = \left(ct'\right) = \left(ct + vt'\right)$$
$$\left(\#\right)^2 = \left(f_\#\right)^2 = \left(ct'\right)^2 = \left(ct + vt'\right)^2 = \left[\left(ct\right)^2 + \left(vt'\right)\right]^2 + \left[2\left(ct\right)\left(vt'\right)\right]$$
$$\left(ct'\right)^2 = \left[\left(ct\right)^2 + \left(vt'\right)\right]^2 + \left[2\left(ct\right)\left(vt'\right)\right]$$

$\left[\left(ct\right)^2 + \left(vt'\right)\right]^2$ is the Existence term and $\left[2\left(ct\right)\left(vt'\right)\right]$ is the Interaction (Entanglement) term.

The Entanglement term represents the change in entropy as the area of the triangle in the RUC representation in each quadrant, depending on the direction of the rotation in each quadrant.

$\left[2\left(ct\right)\left(vt'\right)\right] = 4\left[\frac{1}{2}\left(ct\right)\left(vt'\right)\right] = 4\left(A_\vartriangle\right)$ This is analogous to Beckenstein's concept that entropy is proportional to area (mentioned in Stephen Hawking's "A Brief History of Time").

In Radial "Coordinates"

$\pi\left(ct'\right)^2 = \pi\left[\left(ct\right)^2 + \left(vt'\right)^2\right] + \pi\left[2\left(ct\right)\left(vt'\right)\right]$ where (Entanglement term)

$$\pi\left[2\left(ct\right)\left(vt'\right)\right] = (ct)\left[(2\pi)\left(vt'\right)\right] = (ct)\left[C\right],\ C := (2\pi)\left(vt'\right)$$
$$\left(r_0\right)\left[2\pi\left(r'\right)\right] = r_0 C_{r'}\ , r_0 := (ct), r' := (vt')$$

$$\pi\left(r_\#\right)^2 = \pi\left[\left(r_0\right)^2 + \left(r'\right)^2\right] + \left[\left(r_0\right)2\pi\left(r'\right)\right] = \left[\left(r_0\right)\left(2\pi C_{r'}\right)\right]$$

The Entanglement term appears as the initial radius state $\left(r_0\right)$ "string" multiplied by the circumference "loop" of the perturbing state $\left(2\pi C_{r'}\right)$

Two Body States

There are three cases:

1. $vt' = 0$ (No change to the state)

   $(ct')^2 = (ct)^2 \leftrightarrow t' = t$

2. $vt' < 0$ (Radiation)

   $$\frac{(ct')^2}{(ct')^2} = \left(1_{(ct')}\right)^2 = 1_{(ct')^2} = \left[\left(\frac{1}{\gamma}\right)^2 (\pm\beta)^2\right] + \left[2\frac{(\pm\beta)}{\gamma}\right], \quad \frac{t'}{t} := \gamma, \beta := \left(\frac{v}{c}\right)$$

   $1_{(ct')^2}$ is the final state from an initial state $\beta = 0, t' = t$

   $\left[\left(\frac{1}{\gamma}\right)^2 (\pm\beta)^2\right] - 2\left[\frac{(\pm\beta)}{\gamma}\right] > 0$ in the context of the complete equation, since $1_{(ct')^2} > 0$

   $$h := \pm\frac{\beta}{\gamma}$$

   $$h^2 = 2S^2 = 2\left(\pm\frac{\beta}{\gamma}\right)^2$$

   $$S = \frac{h}{\sqrt{2}}$$

   Where $S := \pm\frac{\beta}{\gamma}$ only in the context of the complete system

   The Trigonometric identity:

   $$\left\{\left(1_{(ct')}\right)^2 = \left[\left(\frac{1}{\gamma}\right)^2 + (\beta)^2\right]\right\} \equiv \left\{\left(1_{(ct')}\right)^2 = \left[\cos^2\theta + \sin^2\theta\right]\right\}$$

   Is derived from the complex relations

   $$\psi = \left(1_{(ct)}\right) = \left[\cos\theta + \sin\theta\right]$$

   $$\psi^* = \left(1_{(ct)}\right)^* = \left[\cos\theta - \sin\theta\right]$$

   $$\left[\psi\psi^*\right] = \left(1_{(ct)}\right)^2 = \left[\cos^2\theta + \sin^2\theta\right]$$

3. $vt' > 0$ (Absorption)

   $$\gamma^2 = \left[\left(1_{(ct)}\right)^2 + (\gamma\beta)^2\right] + \left[2(\beta\gamma)\right]$$

   γ^2 is the final state from an initial state $1_{(ct)^2}$ where $\beta = 0, t' = t$

   The Hyperbolic identity:

$$\left\{\gamma^2 = \left[\left(1_{(ct)}\right)^2 + \left(\gamma\beta\right)^2\right]\right\} \equiv \left\{\left[\cosh^2\theta\right] = \left[\left(1_{(ct)}\right)^2 + \sinh^2\theta\right]\right\}$$

Is derived from the complex relations:

$$\psi = \cosh\theta = \left(1_{(ct)}\right) + \sinh\theta$$

$$\psi^* = \left[\cosh\theta\right]^* = \left(1_{(ct)}\right) - \sinh\theta$$

$$\left[\psi\psi^*\right] = \left[\cosh^2\theta\right] = \left[\left(1_{(ct)}\right)^2 + \sinh^2\theta\right]$$

(For radial interpretation, multiply the second order relationships by π)

4. The rate of change for both Radiation and Absorption is given by $\Delta = \dfrac{\beta}{1/\gamma} = \gamma\beta$

Vector vs Real number Matrix Representations

Real Numbers

$$c = \left(a \pm b\right),\, b < a$$

$$c^2 = a^2 + b^2 + 2(ab) = Tr\begin{vmatrix} a & 0 \\ 0 & b \end{vmatrix}^2 + Det\begin{vmatrix} a & a \\ -b & b \end{vmatrix}$$

$$c := 1 + 1` = 2$$

$$c^2 = 4(1^2) = 1^2 + 1^2 + 2(1^2) = Tr\begin{vmatrix} 1 & 0 \\ 0 & 1 \end{vmatrix}^2 + Det\begin{vmatrix} 1 & 1 \\ -1 & 1 \end{vmatrix}$$

Spin is represented by the vectors $\left|\dfrac{a}{-b}\right|$ and $\left|\dfrac{a}{b}\right|$ where

$$Det\begin{vmatrix} a & a \\ -b & b \end{vmatrix} = 2ab > 0$$

$$h^2 = 2S^2 = 2\left(\sqrt{ab}\right)^2 = 2ab$$

$$S = \frac{h}{\sqrt{2}}$$

Positron

$$h^2 = 2\cos\theta\sin\left(\theta\right)$$
$$= 2\cos\theta\sin\left(\theta\right)$$

Electron (note that $h^2 > 0$ in the context of the full equation

$$h^2 = 2\cos\theta\sin\left(-\theta\right)$$
$$= -2\cos\theta\sin\left(\theta\right)$$

Note that this result is not equivalent to the 4D representation where:

$$Tr\begin{vmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{vmatrix}^2 = Tr\begin{vmatrix} (1)^2 & 0^2 & 0^2 & 0^2 \\ 0^2 & (1)^2 & 0^2 & 0^2 \\ 0^2 & 0^2 & (1)^2 & 0^2 \\ 0^2 & 0^2 & 0^2 & (1)^2 \end{vmatrix} = 1^2 + 1^2 + 1^2 + 1^2$$

Since the former includes Entanglement and the latter does not: (i.e. the sum consists only of existing elements that do not interact).

Vector Representation (a,b)

$$\left|M_{(a,b)}\right| := \begin{vmatrix} a & 0 \\ 0 & b \end{vmatrix}$$

$$\psi = a + ib$$

$$\psi^* = a - ib$$

$$\psi\psi^* = \left[a^2 + b^2\right]\left[+(a)(ib) - (a)(ib)\right] = \left[a^2 + b^2\right] = Tr\left|M_{(a,b)}\right|^2 = Tr\begin{vmatrix} a & 0 \\ 0 & b \end{vmatrix}^2 = Tr\begin{vmatrix} a^2 & 0 \\ 0 & b^2 \end{vmatrix}$$

Note that the interaction product ab does not appear directly, since it is factored out in the conjugation process. That said, note that this product appears (as real) in both the dot and cross products of vector operations.

Examples

Pythagorean Triple $(5,4,3)$

$$5 = 4 + 3i$$

$$5^* = 4 - 3i$$

$$55^* = 25 = 4^2 + 3^2 = 16 + 9$$

$$\psi\psi^* = \left[a^2 + b^2\right]$$

$$25 = 5^2 = 4^2 + 3^2$$

Special Theory of Relativity

$$\# = (ct) + (vt')$$

$$\#^2 = \left[(ct)^2 + (vt')^2\right] + \left[2(ct)(vt')\right]$$

$$\psi := (ct) + (vt')$$

$$\psi^* := (ct) + (vt')$$

$$\psi\psi^* := (ct)^2 + (vt')^2$$

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

Setting $\psi\psi^* = (ct')^2$ and solving the equation $(ct')^2 = (ct)^2 + (vt')^2$ for t' yields the "Time Dilation" equation:

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

Note that $\beta = \frac{v}{c} = \frac{mv}{mc} = (1_m)\left(\frac{v}{c}\right) = (1_m)(\beta)$ is true for any value or representation of m whatsoever, but for physics can be interpreted as classical momentum as above:

$$\beta = \frac{v}{c} = \frac{mv}{mc} = \frac{P}{P} = (1_m)\left(\frac{v}{c}\right) = (1_m)(\beta)$$

classical energy:

$$\beta^2 = \frac{v}{c} = \frac{\left(\frac{1}{2}\right)mv^2}{\left(\frac{1}{2}\right)mc^2} = \frac{E}{E} = \left(1_{\left(\frac{1}{2}m\right)}\right)\left(\frac{v}{c}\right)^2 = \left(1_{\left(\frac{1}{2}m\right)}\right)(\beta)^2$$

Or even relativistic energy

$$\beta^2 = \frac{v}{c} = \frac{(mv)^2}{(mc)^2} = \frac{E}{E} = \left(1_{(m^2)}\right)\left(\frac{v}{c}\right)^2 = \left(1_{(m^2)}\right)(\beta)^2$$

Historically, the equation for Special Relativity can be related to Lorentz' characterization of the null results of the Michaelson-Morley. Lorentz assumed that one of the arms of the apparatus contracted with respect to the other to account for the null measurement during its travel through the aether.

Introduction to the Theory of Relativity by Peter Gabriel Bergmann

By equating the arms of the apparatus to be directionally independent he began with the equation:

$(x - vt)\alpha = c(\gamma x + \beta t)$ which can be interpreted as equal radii of two circles.

Squaring both sides results in $(x - vt)^2 \alpha^2 = c^2 (\gamma x + \beta t)^2$

(note that multiplying by π yields their areas, which can be interpreted as energies:

$\pi\left[(x-vt)^2\alpha^2\right]=\pi\left[c^2(\gamma x+\beta t)^2\right]$ where the radius on the l.h.s. is $r_L=(x-vt)\alpha$, on the r.h.s. is c $r_R=\left[c(\gamma x+\beta t)\right]$ and $r_L=r_R=r$ o that $\pi r^2=\pi(r_L)^2==\pi(r_R)^2$

Lorentz then solves the equation $(x-vt)^2\alpha^2=c^2(\gamma x+\beta t)^2$ by eliminating the parameters α and γ on each side of the equation by expanding it and equating coefficients to arrive at his two equations for the coordinate transformation for the shrinkage of the arms in the direction of motion:

$$x'=(x-vt)\Gamma$$
$$t'=t\left[1-\left(\frac{vx}{c^2}\right)\right]\Gamma \text{ where } \Gamma=\frac{1}{\sqrt{1-\beta^2}},\ \beta=\frac{v}{c}.$$

(Note that in the process of solving the equation, Lorentz had to choose an imaginary root to arrive of his equations).

Setting the speed of light constant so that $x=ct\leftrightarrow x'=ct'$ and multiplying the lower equation by the constant c results in the single equation:

$x'=(x-vt)\Gamma$ or $t'=(t-vt)\Gamma$

Removing the spatial translation vt from the equation $(vt)=0$ results in the STR “time dilation” equation:

$$t'=(t)\Gamma$$

(The rest is – not necessarily brief – history)

Pauli Matrices

The Stern-Gerlach Experiment (Wikipedia) resulted in the discovery of the "spin" of charged particles, and Wolfgang Pauli responded with three matrices that now exist as the foundation of the Special Unitary Group SU(2) (Wikipedia)

The Pauli Matrices (Wikipedia)

$$|\sigma_1| = \begin{vmatrix} 0 & 1 \\ 1 & 0 \end{vmatrix}, |\sigma_2| = \begin{vmatrix} 0 & -i \\ i & 0 \end{vmatrix}, |\sigma_3| = \begin{vmatrix} 1 & 0 \\ 0 & -1 \end{vmatrix}$$

$$|\sigma_{12}| := |\sigma_1| + |\sigma_2| = \begin{vmatrix} 0 & 1-i \\ 1+i & 0 \end{vmatrix} = \begin{vmatrix} 0 & \psi^* \\ \psi & 0 \end{vmatrix}$$

$$Tr|\sigma_{12}| = 0,\ Det|\sigma_{12}| = -\psi^*\psi = 1^2 + 1$$

$$1 \neq 1$$

Note the analog of $-\psi^*\psi$ to the definition of the Hamiltonian in Quantum Mechanics

Note that multiplying each of the equations by the "spin" vectors $\begin{vmatrix} 1 \\ 0 \end{vmatrix}$ and $\begin{vmatrix} 0 \\ 1 \end{vmatrix}$ maps the matrix components into a spin vectors, but changes their position ("up" or "down")

$|\sigma_1|$ ---------------------

$$|\sigma_1| = \begin{vmatrix} 0 & 1 \\ 1 & 0 \end{vmatrix}, Tr|\sigma_1| = 0,\ Det|\sigma_1| = -1^2$$

$$|\sigma_1|^2 = \begin{vmatrix} 0 & 1 \\ 1 & 0 \end{vmatrix}^2 = \begin{vmatrix} 1^2 & 0 \\ 0 & 1^2 \end{vmatrix}, Tr|\sigma_1| = 0,\ Det|\sigma_1| = (1^2)(1^2) = 1^4$$

$$\# = (1^2 + 1^2)$$

$$\#^2 = (1^2 + 1^2)^2 = [1^4 + 1^4] + [2(1^2)(1^2)]$$

where $[1^4 + 1^4]$ represents the existence term and $[2(1^2)(1^2)] = 2(1^4)$ represents the entanglement (interaction) term.

$|\sigma_2|$ ---------------------

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

$$|\sigma_2|^2 = \begin{vmatrix} -(i)^2 & 0 \\ 0 & -(i)^2 \end{vmatrix} = \begin{vmatrix} 1 & 0 \\ 0 & 1 \end{vmatrix},\ Tr|\sigma_2|^2 = 1+1 = 2,\ Det|\sigma_2|^2 = (1)^2$$

$|\sigma_2|^2$ forms the basis of an positive imaginary space of second order $(1,1)$.

$|\sigma_3|$ ---------------------

$$|\sigma_3| = \begin{vmatrix} 1 & 0 \\ 0 & -1 \end{vmatrix}$$

$$Tr|\sigma_3| = 1+(-1) = (1-1) = 0 \leftrightarrow 1 = 1$$

$$Det|\sigma_3| = -(1)^2$$

$$|\sigma_3|^2 = \begin{vmatrix} 1 & 0 \\ 0 & -1 \end{vmatrix}^2 = \begin{vmatrix} 1^2 & 0 \\ 0 & (-1)(-1) \end{vmatrix} = \begin{vmatrix} 1^2 & 0 \\ 0 & 1^2 \end{vmatrix}$$

$$Tr|\sigma_3| = 1+(-1) = (1-1) = 0 \leftrightarrow 1 = 1$$

$$Det|\sigma_3| = (1)^2(1)^2 = (1)^4$$

As expressed, the Pauli matrices includes elements of both first and second order.

In order that the elements of $|\sigma_1|$ and $|\sigma_3|$ are the same order, the matrix must be re-caste with all terms as square roots:

$|\sigma_1|$ ---------------------

$$|\sigma_1| = \begin{vmatrix} 0 & \sqrt{1} \\ \sqrt{1} & 0 \end{vmatrix},\ Tr|\sigma_1| = 0,\ Det|\sigma_1| = -1$$

$$|\sigma_1|^2 = \begin{vmatrix} 1 & 0 \\ 0 & 1 \end{vmatrix},\ Tr|\sigma_1|^2 = 1+1 = 2, Det|\sigma_1|^2 = 1^2$$

$Det|\sigma_1| = -1$ is interpreted to mean that only the Entanglement terms are included:

$$\# = \sqrt{1} - \sqrt{1} = 0$$

$$\#^2 = \left[\left(\sqrt{1}\right)^2 + \left(\sqrt{1}\right)^2\right] - 2\left(\sqrt{1}\right)\left(\sqrt{1}\right) = \left[\left(\sqrt{1}\right)^2 + \left(\sqrt{1}\right)^2\right] - 2(1)$$

Nothing exists, but there is an Entanglement anyway.

$|\sigma_3|$ ----------------------

$$|\sigma_3| = \begin{vmatrix} \sqrt{1} & 0 \\ 0 & i \end{vmatrix}, Tr|\sigma_3| = \sqrt{1} + i, Det|\sigma_3| = \left(\sqrt{1}\right) i \begin{vmatrix} 1 & 0 \\ 0 & 1 \end{vmatrix}$$

so that $|\sigma_3|^2 = \begin{vmatrix} \sqrt{1} & 0 \\ 0 & i \end{vmatrix}^2 = \begin{vmatrix} 1 & 0 \\ 0 & -1 \end{vmatrix}, Tr|\sigma_3|^2 = 1 + (-1) \neq 2, Det|\sigma_3|^2 = (1)(-1) \neq 1^2$

(Note that the SU(2) does not include the identity (existence) matrix $|I| := \begin{vmatrix} 1 & 0 \\ 0 & 1 \end{vmatrix}$ where

$Tr|I| := 1 + 1 = 2(1)$ (Existence Matrix)

$Det|I| = (1)(1) = 1^2$ (Self-Interaction Entanglement Matrix)

and $|I|^2 := \begin{vmatrix} 1^2 & 0 \\ 0 & 1^2 \end{vmatrix}$

$Tr|I|^2 = \left[1^2 + 1^2\right] = 2\left(1^2\right)$ (Existence matrix)

$Det|I|^2 = \left(1^2\right)\left(1^2\right)$ (Entanglement matrix)

(as an exercise set all the imaginary elements to 0.)

Note that the interaction matrix:

$\begin{vmatrix} 1 & 1 \\ -1 & 1 \end{vmatrix} = \begin{vmatrix} 1 & 0 \\ 0 & 1 \end{vmatrix} + \begin{vmatrix} 0 & 1 \\ -1 & 0 \end{vmatrix} = |I| + \sigma_3$, (where $|I|$ is the identity matrix), can be expressed as two vectors:

$$\begin{vmatrix} 1 & 1 \\ -1 & 1 \end{vmatrix} = \begin{vmatrix} 1 \\ -1 \end{vmatrix} \begin{vmatrix} 1 \\ 1 \end{vmatrix}$$

$$\begin{vmatrix} 1 \\ -1 \end{vmatrix} \bullet \begin{vmatrix} 1 \\ 1 \end{vmatrix} = 0$$

$$\begin{vmatrix} 1 \\ -1 \end{vmatrix} \otimes \begin{vmatrix} 1 \\ 1 \end{vmatrix} = \begin{vmatrix} 1 & 1 & 0 \\ -1 & 1 & 0 \\ 0 & 0 & 0 \end{vmatrix} \to \begin{vmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 2 \end{vmatrix}$$

Pauli Matrices as Pythagorean Triples

To see the relevance of these matrices it is helpful to re-write them as

$$|\sigma_1| = \begin{vmatrix} 0 & a \\ a & 0 \end{vmatrix}, |\sigma_2| = \begin{vmatrix} 0 & -ib \\ ib & 0 \end{vmatrix}, |\sigma_3| = \begin{vmatrix} a & 0 \\ 0 & ib \end{vmatrix}$$, where $a = 1, b = 1$

$$|\sigma_{1+2}| = |\sigma_1| + |\sigma_2| = \begin{vmatrix} 0 & a \\ a & 0 \end{vmatrix} + \begin{vmatrix} 0 & -ib \\ ib & 0 \end{vmatrix} = \begin{vmatrix} 0 & a-ib \\ a+ib & 0 \end{vmatrix} = \begin{vmatrix} 0 & \psi^* \\ \psi & 0 \end{vmatrix}$$, where:

$$\psi := a + ib$$
$$\psi^* := a - ib$$
$$\psi\psi^* = a^2 + b^2$$

The matrices become a little clearer if a Pythagorean Triple is applied:

e.g. $(5, 4, 3)$, so that:

$$|\sigma_1| = \begin{vmatrix} 0 & 4 \\ 4 & 0 \end{vmatrix}, |\sigma_2| = \begin{vmatrix} 0 & -3i \\ 3i & 0 \end{vmatrix}, |\sigma_3| = \begin{vmatrix} 4 & 0 \\ 0 & 3i \end{vmatrix}$$

$$|\sigma_{1+2}| = |\sigma_1| + |\sigma_2| = \begin{vmatrix} 0 & 4 \\ 4 & 0 \end{vmatrix} + \begin{vmatrix} 0 & -3i \\ 3i & 0 \end{vmatrix} = \begin{vmatrix} 0 & 4-3i \\ 4+3i & 0 \end{vmatrix} = \begin{vmatrix} 0 & \psi^* \\ \psi & 0 \end{vmatrix}$$

$$Det|\sigma_{1+2}| = Det\begin{vmatrix} 0 & \psi^* \\ \psi & 0 \end{vmatrix} = -\psi\psi^* = -\left(a^2 + b^2\right) = -\left(4^2 + 3^2\right) = -25$$

Recall that

$$49 = [\psi\psi^*] + 2\left[(4)(3)\right] = [25] + [24] \leftrightarrow [\psi\psi^*] = [25]$$

So that:

$$49 - [\psi\psi^*] = 49 - \left[a^2 + b^2\right] = 49 - \left[(5)(5^*)\right] = 49 - [25] = 24$$

Therefore, for Pythagorean triples, the equations using complex numbers are consistent with those of real numbers, provided that **only the scalars are applied**. That is, the fact that the axes of the complex plane are perpendicular to the real plane is irrelevant, so there is no product operation (e.g. ab) when the complex scalars are applied. Again,

$\psi := a + ib$
$\psi^* := a - ib$
$\psi\psi^* = a^2 + b^2 + iab - iab = a^2 + b^2$

In the conjugation process.

Then note that:

$$Tr|\sigma_3| = Tr\begin{vmatrix} a & 0 \\ 0 & ib \end{vmatrix} = a + ib\text{ , } Det|\sigma_3| = (ab)i$$

But $Det|\sigma_3| = (ab)i$

which returns the product operation back to the complex characterization of the Pauli matrices for Pythagorean triples if only scalars are involved the elements are of the same order $\left(\sqrt{a}, \sqrt{b}\right)$, where $\left(\sqrt{a}, \sqrt{b}\right)^2 = (a, b)$

Returning to the actual Pauli Matrices

$$|\sigma_{1+2}| = |\sigma_1| + |\sigma_2| = \begin{vmatrix} 0 & 1 \\ 1 & 0 \end{vmatrix} + \begin{vmatrix} 0 & -i \\ i & 0 \end{vmatrix} = \begin{vmatrix} 0 & 1-i \\ 1+i & 0 \end{vmatrix} = \begin{vmatrix} 0 & \psi^* \\ \psi & 0 \end{vmatrix},$$

where:

$\psi := 1 + i$
$\psi^* := 1 - i$,
$\psi\psi^* = 1^2 - i^2 = 1^2 + 1$

The vector relations become:

$$Tr|\sigma_1| = Tr|\sigma_2| = 0, Tr|\sigma_3| = 1 - 1$$

$$Det|\sigma_1| = -1^2, Det|\sigma_2| = -1, Det|\sigma_3| = (1)(-1) = (-1)$$

$$Tr\left(|\sigma_{1+2}|+|\sigma_3|^2\right)=Tr\left\{\begin{vmatrix}1^2 & \psi^* \\ \psi & -1\end{vmatrix}\right\}=1+i$$

$$Det\left\{\begin{vmatrix}1 & \psi^* \\ \psi & i\end{vmatrix}\right\}=(1)(i)-[\psi^*\psi]=1i-(1^2+1)$$

$$Tr|\sigma_3|=Tr\begin{vmatrix}\sqrt{1} & 0 \\ 0 & i\end{vmatrix}=i(1)$$

$$(|\sigma_3|)^2=\left(\begin{vmatrix}\sqrt{1} & 0 \\ 0 & i\end{vmatrix}\right)^2=\left(\begin{vmatrix}1 & 0 \\ 0 & i^2\end{vmatrix}\right)=\left(\begin{vmatrix}1 & 0 \\ 0 & -1\end{vmatrix}\right)$$

$$Tr(|\sigma_3|)^2=1-1$$

For a real E field and an imaginary B field, the expressions become:

$$\psi := E+iB$$
$$\psi^* := E-iB$$
$$\psi\psi^* = E^2+B^2$$

Where the product EB has been eliminated by conjugation, which is interpreted to mean that the E and B fields do not interact.

$$|\sigma_{1+2}|=|\sigma_1|+|\sigma_2|=\begin{vmatrix}0 & E \\ E & 0\end{vmatrix}+\begin{vmatrix}0 & -B \\ B & 0\end{vmatrix}=\begin{vmatrix}0 & E-B \\ E+B & 0\end{vmatrix}=\begin{vmatrix}0 & \psi^* \\ \psi & 0\end{vmatrix}$$

Again, $Tr\left(\begin{vmatrix}0 & \psi^* \\ \psi & 0\end{vmatrix}\right)=0,\ Det\left(\begin{vmatrix}0 & \psi^* \\ \psi & 0\end{vmatrix}\right)=-(\psi^*\psi)$, where the Trace and the Determinant suggest that the characterization is that of interaction, but not existence.

Correction to Pauli Matrices

For group elements in the same order:

$$\left|\sigma_{1+2}\right| = \left|\sqrt{\sigma_1}\right| + \left|\sigma_2\right| = \begin{vmatrix} 0 & \sqrt{1} \\ \sqrt{1} & 0 \end{vmatrix} + \begin{vmatrix} 0 & -i \\ i & 0 \end{vmatrix} = \begin{vmatrix} 0 & \sqrt{1}-i \\ \sqrt{1}+i & 0 \end{vmatrix} = \begin{vmatrix} 0 & \psi^* \\ \psi & 0 \end{vmatrix}$$

$$Tr\left|\sigma_{1+2}\right| = 0,\ Det\left|\sigma_{1+2}\right| = \psi^*\psi = 1+1 = 2$$

Conclusion

The bottom line is that for the entanglement relations for two bodies

$$\# = a + b$$

$$(\#)^2 = [a^2 + b^2] + [2ab]$$ = “existence” + “interaction”

(where interaction [2ab] represents spin, entropy, entanglement, etc.)

Special Theory of Relativity (STR)

uses the expression $(\#)^2 = \psi\psi^* = c^2 = [a^2 + b^2]$ and claims that photons do not interact (not to mention everything else) by omitting interaction (entropy) S

$$h^2 = 2(ab) = 2S$$

$$S = \frac{h^2}{2}$$ (h is Planck's number, and S is "spin"

QM uses the expression $S = (1/2)(2ab) = (+/-)ab$

by omitting existence $\psi\psi^* = [a^2 + b^2]$

And by (Goldbach’s conjecture)

$$1_n + 1_n = 2(1_n)(1_n) = 2(1_n)$$

$$n + n = 2n$$

omits odd numbers, and thus existence of single particles 1_n

Just as the cross product omits existence by transferring ALL of x and y into a separate dimension z as a scalar and the dot product reduces interacting elements xy to a scalar with no dimension at all.

(GTR is worse but the same error see **Einstein's Mistake** (my Web LInk) on my website) where I show the mistake using his own results.

And all because Pythagoras was wrong Fermat was right, even for the cases n = 2..... (but Pythagoras didn't know about imaginary numbers either, so at least he has an excuse) The proof of Fermat’s conjecture $c^n \neq a^n + b^n,\ (a,b,c,n) > 0,\ n > 1$ was discovered within two months after it appeared by a mathematics “C” student, who was then hustled away by men in black coats, never to be seen or heard from again.

Calculus

Define an empty region of space (e.g. between galaxies, where temporarily there is no CBR.

Define a single existing force $f(x) := c\tau$ moving across this empty space; if there is no force then $f(x) := 0$ which is defined for all points within the space. Since it is moving, position (an "origin") cannot be defined independently of the force.

Define a second equal force within this space (related by addition: $+$) that is non-interacting (i.e., multiplication is not defined), so the count is:

$$\# := f(x) + f(x) = 2f(x) = Tr\begin{vmatrix} f(x) & 0 \\ 0 & f(x) \end{vmatrix}$$

The term $\# = f(x) + f(x)$ expresses the existence of the two forces. In order to multiply each other, both elements must be defined, so

$\#^2 = [f(x) + f(x)]^2 = \left\{[f(x)]^2 + [f(x)]^2\right\} + 2[f(x)][f(x)]$ where the interaction (multiplication) term is: $h^2 = 2[f(x)][f(x)] = 2[f(x)]^2$

Note that $\#^2 \neq \left\{[f(x)]^2 + [f(x)]^2\right\}$

The matrix relation is:

$$|\#|^2 := Tr\begin{vmatrix} f(x) & 0 \\ 0 & f(x) \end{vmatrix}^2 + Det\begin{vmatrix} f(x) & f(x) \\ -f(x) & f(x) \end{vmatrix}$$
$$= \left[f(x)^2 + f(x)^2\right] + [2f(x)f(x)]$$

Where the term $\left[f(x)^2 + f(x)^2\right]$ expresses the existence of the elements in second order, and the term $[2f(x)f(x)]$ expresses the interaction of each of the two terms in first order (with the product in second order).

Suppose the second force is not equal to the first force, where the first force is the initial state. The second force can then be expressed as:

$f(x+h) := v\tau'$ so that $\# = f(x) + f(x+h)$ and

$\#^2 = f(x)^2 + f(x+h)^2 + 2f(x)f(x+h)$ where

$\lim_{h\to 0}[f(x) + f(x+h)] = [f(x) + f(x)]$ as above.

The interaction term

Consider the term $2f(x)f(x+h) = 4(\left[\frac{1}{2}f(x)f(x+h)\right])$ and note that the term expresses the areas of four right triangles, with each given by $A_i = \left[\frac{1}{2}f(x)f(x+h)\right]_i$, $i = 1...4$