The Grand Unified Theory as expressed in real numbers

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The following is a discussion of the relations between

1. the Relativistic Unit Circle
2. The Binomial Expansion
3. Fermat's Theorem and Euler's Conjecture
4. Lorentz rotations
5. The number e and exponential functions
6. Imaginary numbers
7. The relation between all the above and entropy

I begin by noting that Newton's definitions of momentum and energy defined in terms of the parameters $\beta = \frac{v}{c}$ and $\gamma = \frac{\tau'}{\tau}$.

In order to exist, a single valued function must be positive, which can only be destroyed by imaginary numbers:, since $0 = 0 = (x)^2 + (ix)^2$, where $i = \sqrt{-1}$ and $\varphi(x) = x^2 \Rightarrow i = 0$

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

The negative sign only applies to the angle $\pm\theta$ in a "Lorentz" rotation where

$$\cosh^2\theta = 1^2 + \sinh^2\theta = (1 + i\sinh\theta)(1 - i\sinh\theta)$$,

but

$$\varphi^2 = 1^2 + (\beta\gamma)^2 + 2\beta\gamma = (1 + \beta\gamma)^2$$
$$\gamma^2 = 4(1^2) \Leftrightarrow \beta = \gamma = 1$$
$$\gamma^2 = 1^2 \Leftrightarrow \beta = 0,\ \gamma = 1$$
$$\psi\psi^* = (\gamma + i\beta)(\gamma - i\beta) = \gamma^2 + \beta^2 = (1^2 + 1^2) = 2\ , \gamma = 1, \beta = 1$$

for the case $n = 2$, where n is the dimension of the physical (or mathematical) system.

For momentum, define entropy as $e(n) = \sum_n e^n$ so that $\frac{d\left[e(n)\right]}{dn} = e(n)$ where

$e^0 = 1,\ e^1 = e$, and

$$e^n = \lim_{n\to\infty}\left(1+\frac{1}{n}\right)^n = \lim_{\substack{n\to\infty \\ \beta=n}}\left(1+\frac{1}{\beta}\right)^\beta = \lim_{\substack{n\to\infty \\ \gamma=n}}\left(1+\frac{1}{\gamma}\right)^\gamma = \lim_{\substack{n\to\infty \\ \beta\gamma=n}}\left(1+\frac{1}{\beta\gamma}\right)^{\beta\gamma}$$

$$P = \varphi_P = m_0 v = m_0 \beta\gamma,\ c^0 = 1,\ \gamma^0 = \left(\frac{\tau'}{\tau}\right)^0$$

$$v^0 = c^0 \Rightarrow \varphi_P = m_0$$

$$\left(m_0\right)^0 = 1$$

$$P^0 = \left(\varphi_P\right)^0 = \left[1_{m_0}\left(\frac{1}{1}\right)_{(\tau,\tau')}\right]^0 = 1^0$$

$$P^1 = \left(\varphi_P\right)^1 = \left(m_0\right)^1 v^1 = \left(m_0\right)^1\left(\beta^1\gamma^1\right) = \left(m_0\right)^1\left(\frac{v^1}{c^1}\right)\left(\frac{\left(\tau'\right)^1}{\tau^1}\right)$$

$$= \left(m_0\right)^1 v^1\left(\frac{1}{c^1}\right)\left(\tau'\right)^1\left(\frac{1^1}{\tau^1}\right)$$

$$c^1 = c^0 = 1^0$$

$$\left(\tau'\right)^1 = \tau^1 \Rightarrow \left(\frac{\left(\tau'\right)^1}{\tau^1}\right)^0 = 1^0$$

$$P^1 = \left(\varphi_P\right)^1 = \left(m_0\right)^1 v^1$$

$$E = m_0 v^2 = m_0 c^2 = m_0\left(1\right)^2$$

The single valued function $c\tau' = c\tau + v\tau'$ is complete in the single set of positive real numbers $\{c, v, \tau, \tau'\} \equiv \{(c\tau), (v\tau')\}$ where $\{(c\tau), (v\tau')\}$ defines the multiplicative relations in the two independent subsets $x = (c\tau)$ and $y = (v\tau')$.

Note that a matrix $|M_{(n)}|$ (where $n > 1$ is not single valued, but $Tr(M) = \sum_n x_n$ and that the determinant only exists for diagonal matrices.

$$c\tau' = c\tau + v\tau'$$

$$\gamma \triangleq \frac{\tau'}{\tau},\ \beta \triangleq \frac{v}{c}$$

$$c = 1 \Leftrightarrow \beta = v \Leftrightarrow 1 \Leftrightarrow v = \left(\frac{v}{c}\right)c = \beta c$$

$$(x_c)_{ij} = c_i\tau_j, (i, j) = (1, 2)$$

$$c_i\tau_j = c_j\tau_j + c_i\tau_i$$

Note that I and j do not commute, in the sense that

$$\frac{\tau_i}{\tau_j} \neq \frac{\tau_j}{\tau_i},\ j \neq i$$

$$\frac{\tau_i}{\tau_j} = \frac{\tau_j}{\tau_i} = 1, \quad j = i$$

$$v < c,\ \beta < 1$$

$$1 = \frac{1}{\gamma} + \beta$$

$$v > c,\ \beta > 1$$

$$\gamma = 1' + \beta\gamma,$$

$$1' = \gamma(1 - \beta)$$

$$v = c$$

$$\beta = 1,\ \gamma = 0$$

$v < c,\ \beta < 1$

$$1 = \frac{1}{\gamma} + \beta$$

$n = 2$

$$\left(1_{\varphi}\right)^2 = \left(\frac{1}{\gamma} + \beta\right)^2 = \left(\frac{1}{\gamma}\right)^2 + \beta^2 + 2\frac{\beta}{\gamma}$$

$i = \sqrt{-1}$

$$\left(1_{\psi}\right)^2 = \left(\frac{1}{\gamma} + i\beta\right)\left(\frac{1}{\gamma} - i\beta\right) = \left(\frac{1}{\gamma}\right)^2 + \beta^2$$

$$\left(1_{\varphi}\right)^2 = \left(1_{\psi}\right)^2 \Leftrightarrow i\beta = 0 \Leftrightarrow i = 0$$

$n > 2$

$$\left(1_{\varphi}\right)^n = \left(\frac{1}{\gamma} + \beta\right)^n = \left(\frac{1}{\gamma}\right)^n + \beta^n + rem(\frac{1}{\gamma}, \beta, n)$$

$$\left(1_{\psi}\right)^n = \left[\left(\frac{1}{\gamma}\right)^n + \beta^n + irem(\frac{1}{\gamma}, \beta, n)\right]\left[\left(\frac{1}{\gamma}\right)^n + \beta^n - irem(\frac{1}{\gamma}, \beta, n)\right] = \left(\frac{1}{\gamma}\right)^n + \beta^n$$

$k\left(1_{\varphi}\right)^n = k\left(\frac{1}{\gamma} + \beta\right)^n$ can only be an integer if $\beta = 0 \Rightarrow v = 0 \Rightarrow \gamma = 1$

Compare $\gamma = x,\ \beta = y$

$$k\left(1_{\varphi}\right)^n = k\left(\frac{1}{x} + y\right)^n$$

$v > c,\ \beta > 1$

$\gamma = 1' + \beta\gamma$

$n = 2$

$\gamma_{\varphi}{}^{2} = (1' + \beta\gamma)^{2} = (1')^{2} + (\beta\gamma)^{2} + 2\beta\gamma$

$(1')^{2} = \gamma^{2} - (\beta\gamma)^{2} - 2\beta\gamma$

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

$(1')^{2} = \gamma^{2} \Leftrightarrow \beta\gamma = 0 \Leftrightarrow v = 0$

$n > 2$

$\gamma_{\varphi}{}^{mn} = (1' + \beta\gamma)^{mn} = (1')^{mn} + (\beta\gamma)^{mn} + rem(1', \beta\gamma, mn)$

$\gamma_{\varphi}{}^{mn} = (1')^{mn} \Leftrightarrow \beta\gamma = 0 \Leftrightarrow v = 0$

$k\gamma_{\varphi}{}^{mn} = k(1')^{mn}$ k can only be an integer if $\beta\gamma = 0 \Leftrightarrow v = 0$

Compare $\gamma = x,\ \beta = y$

$\varphi_{xy} = x^{2} + y^{2} + 2xy = X^{2} + Y^{2} \Leftrightarrow R = \sqrt{X^{2} + Y^{2}} = \sqrt{x^{2} + y^{2} + 2xy}$

So that R includes the interaction in the redefined coordinate system., where X and Y are no longer orthogonal. The interaction can only be eliminated in the case n=2 because the interaction can be removed by conjugation using imaginary numbers; in this case x and y commute both additively $x + y = y + x$ and multiplicatively $xy = yx$, so one can "imagine) eliminating the interaction term ixy in the expansion $(x + iy)^{2} = x^{2} + y^{2} = (y + ix)^{2} = y^{2} + ix^{2}$. However, because x and y are independent, the origin of each is separate at 0, and the relation (0,0) cannot be specified except by imaginatively eliminating the interaction.

if $x \neq y$; i.e. $(x + iy) \neq (y + ix)$

$$c\tau' = v\tau' + c\tau$$

$$\tau' = \frac{v}{c}\tau' + \tau = \beta\tau' + \tau,\ \beta = \frac{v}{c}$$

$$\tau' = \frac{\tau}{(1-\beta)} = \tau\left(\frac{1}{1-\beta}\right)$$

$$\frac{\tau'}{\tau} = \left(\frac{1}{1-\beta}\right) = \gamma$$

$$x > 0,\ x_c = c\tau,\ x_v = v\tau'$$

Note that β and γ do not commute; that is

$$\beta\gamma \neq \gamma\beta,\ \gamma \neq \beta$$

$$\beta\gamma = \gamma\beta,\ \gamma \equiv \frac{1}{1}, \beta \equiv 0 = \frac{0}{1} \Rightarrow v \equiv 0$$

$$x \triangleq \left(\frac{\tau'}{\tau}\right)^1 = \gamma^1,\ \tau' > \tau,$$

$$\frac{1}{x} = \left(\frac{\tau'}{\tau}\right)_x^{-1} = \left(\frac{\tau}{\tau'}\right)_x^1 = \gamma_x^{-1},\ \tau < \tau'$$

$$e(x) = e^x$$

$$e^x = e^{\gamma_x},\ \tau' > \tau$$

$$e^x = e^{\frac{1}{\gamma_x}},\ \tau' < \tau$$

$$y = \beta = \frac{v_y}{c_y}$$

$$e(y) = e^y = e^\beta$$

$$e^y = e^\beta,\ v > c$$

$$e^y = e^{\frac{1}{\beta}},\ v < c$$

$$e^x e^y = e^{(x+y)} = e^\gamma e^\beta = e^\beta e^\gamma$$

$$x + y = \gamma + \beta = \ln\left[e^{(x+y)}\right] = \ln\left[e^{(\gamma+\beta)}\right]$$

$$e^{\theta_x} = \cos\theta_x$$

$$e^{\theta_y} = \cos\theta_y$$

The Relativistic Unit Circle

Define the two functions

$$\varphi = \psi = c\tau' = v\tau' + c\tau$$
$$\varphi^2 = (v\tau')^2 + (c\tau)^2 + 2(v\tau')(c\tau)$$

Consider the complex conjugate

$$\psi\psi^* = [(c\tau) + i(v\tau')][(c\tau) - i(v\tau')] = (c\tau)^2 + (v\tau')^2 + 0$$

, where the interaction $2(v\tau')(c\tau)$ has been eliminated by imaginary conjugation so that

$$2(v\tau')(c\tau) = 0$$

Note that $\psi\psi^* \neq \varphi^2$

If we now (in our imagination) set $\psi\psi^* = c\tau'$, then this equation can be solved:

$\tau' = \tau\gamma,\ \gamma = \dfrac{1}{\sqrt{1-\beta^2}},\ \beta = \dfrac{v}{c}$. Which is the imaginary "Time Dilation" equation, which only addresses the squared quantities without including the interaction between the constituents, and only includes the imaginary two dimensions of the first order definition. Note that the interaction term (a "cross product") is a multiplication between the two constituent elements. If it is eliminated by setting either $c\tau = 0$ or $v\tau' = 0$, then $c\tau' = v\tau'$ or $c\tau' = c\tau$ so that $\tau' = \tau$ in either case.

See further discussion in The Relativistic Unit Circle , which shows its relation to Fermat's Theorem.

The elimination of the constituent elements by only iincluding the interaction, is the reason the traces of the Pauli, Dirac matrices and the Electromagnetic Field tensor are identically equal to 0, and so identical to that of the null matrix.

$$x = \theta,\ y = i\theta = i\beta$$
$$e(x+iy) = e(\theta + i\theta) = e^{\theta}e^{i\theta} = e^{\theta}e^{0} = (1^{\theta})e^{\theta} = \cos\theta,\ i = 0$$
$$\cos\theta = \frac{1}{\gamma},\ \tau' > \tau$$
$$\cos\theta = \frac{\beta}{\gamma},\ \tau' < \tau$$
$$n\cos\theta = n,\ \theta = 0$$

Multinomial Proof of Fermat's Theorem (Euler's Conjecture)

$$n=2$$
$$x_i=\left(\sqrt{x_i}\right)^2$$
$$\Sigma_{n,m}=\sum_n x_i=\sum_{i=0}^{m}x_i+\sum_{i=m+1}^{n}x_i=\mathrm{X}+\Upsilon$$
$$\left(\Sigma_{n,m}\right)_\varphi^{\ 2}=\left(\mathrm{X}+\Upsilon\right)^2=\mathrm{X}^2+\Upsilon^2+2\mathrm{X}\Upsilon$$
$$\left(\Sigma_{n,m}\right)_\psi\left(\Sigma_{n,m}\right)_\psi*=\mathrm{X}^2+\Upsilon^2=\left(\mathrm{X}+i\Upsilon\right)\left(\mathrm{X}-i\Upsilon\right)$$
$$\left(\Sigma_{n,m}\right)_\varphi^{\ 2}\neq\left(\Sigma_{n,m}\right)_\psi\left(\Sigma_{n,m}\right)_\psi*$$

The interaction term $2\mathrm{X}\Upsilon$ will depend on both m and n.

$$x_i>0,\ n>2$$
$$x_i=\sqrt[n]{\left(x_i\right)^n}$$
$$\left(\Sigma_{n,m}\right)^n=\left(\sum_n x_i\right)^n=\left(\sum_{i=0}^{m}x_i+\sum_{i=m+1}^{n}x_i\right)^n=\left(\mathrm{X}_{0,m}+\Upsilon_{m+1,n}\right)^n=\mathrm{X}_{0,m}{}^n+\Upsilon_{m+1,n}{}^n+rem\left(\mathrm{X}_{0,m}{}^n,\Upsilon_{m+1,n}{}^n,n\right)$$
$$\left(\Sigma_{n,m}\right)^n=\mathrm{X}_{0,m}{}^n+\Upsilon_{m+1,n}{}^n\Leftrightarrow rem\left(\mathrm{X}_{0,m}{}^n,\Upsilon_{m+1,n}{}^n,n\right)=0$$
$$rem\left(\mathrm{X}_{0,m}{}^n,\Upsilon_{m+1,n}{}^n,n\right)=0\Leftrightarrow\left[\mathrm{X}_{0,m}{}^n=0\right]\wedge\Upsilon_{m+1,n}{}^n\Leftrightarrow\left[\left(\Sigma_{n,m}\right)^n=\Upsilon_{m+1,n}{}^n\right]\wedge\left[\left(\Sigma_{n,m}\right)^n=\mathrm{X}_{0,m}{}^n\right]$$

$$\exp\left(\Sigma_{n,m}\right)^n=\exp\left[\mathrm{X}_{0,m}{}^n+\Upsilon_{m+1,n}{}^n+rem\left(\mathrm{X}_{0,m}{}^n,\Upsilon_{m+1,n}{}^n,n\right)\right]$$
$$\mathrm{X}_{0,m}{}^n=1_{(0,m),n}=\mathrm{X}_0{}^n=1$$
$$\exp\left(\Sigma_{n,m}\right)^n=\exp\left[1+\Upsilon_{m+1,n}{}^n+rem\left(\mathrm{X}_{0,m}{}^n,\Upsilon_{m+1,n}{}^n,n\right)\right]=\exp\left[1+\Upsilon_{m+1,n}{}^n+rem\left(1,\Upsilon_{m+1,n}{}^n,n\right)\right],m=1$$
$$e=e^1=\exp(1)=\lim_{\left(\Upsilon_{m+1,n}{}^n\right)\to0}=\lim_{rem\left(\mathrm{X}_{0,m}{}^n,\Upsilon_{m+1,n}{}^n,n\right)\to0}$$
$$\mathrm{X}_{0,m}{}^n=\gamma_{0,m}{}^n=\gamma,\ \Upsilon_{m+1,n}{}^n=\beta_{m+1,n}{}^n=\beta$$

Note that in the Multinomial Expansion, $\gamma\perp\beta$ (γ commutes with β

(Their components only commute additively for $n=1$ and multiplicatively for $n=2$; the components in the Binomial Expansion do not commute in their respective powers)

$$x = \gamma \wedge x = \beta$$

$$e = \lim_{x \to \infty} \left(1 + \frac{1}{x}\right)^{x},\ x > 1$$

$$e = \lim_{x \to 0} (1 + x)^{\frac{1}{x}},\ x < 1$$

$$e=\lim_{n\to\infty}\left(1+\frac{1}{n}\right)^{n}=\lim_{n\to\infty}\left[1^{n}+\left(\frac{1}{n}\right)^{n}+rem\left(1^{n},\left(\frac{1}{n}\right)^{n},n\right)\right]$$

$$n=n\lim_{\substack{v\to c,\\ \gamma\to 1}}\gamma=n\lim_{\substack{v\to 0,\\ \frac{1}{\gamma}\to 1}}\frac{1}{\gamma}$$

$$e=\lim_{n\to\infty}\left\{1+\left(\frac{1}{n}\right)^{n}\right\}\Leftrightarrow\left\{\lim_{n\to\infty}\left[rem\left(1,\left(\frac{1}{n}\right)^{n},n\right)\right]\right\}=0$$

$$e^{1}=e\Leftrightarrow\beta\gamma=\frac{\beta}{\gamma}$$

$$\varphi=\gamma+\beta$$

$$\varphi^{2}=\left(\gamma+\beta\right)^{2}=\gamma^{2}+\beta^{2}+2\gamma\beta$$

$$\gamma=\beta=1\Leftrightarrow\varphi^{2}=4(1^{2})$$

$$\psi\psi^{*}=\left(\gamma+i\beta\right)\left(\gamma+i\beta\right)^{*}=\gamma^{2}+\beta^{2}$$

$$\gamma=\beta=1\Leftrightarrow\psi\psi^{*}=1^{2}+1^{2}=2$$

$$e = \lim_{n\to\infty}\left\{1^n + \left(\frac{1}{n}\right)^n\right\} \Leftrightarrow \lim_{n\to\infty}\left\{rem\left(1^n, \left(\frac{1}{n}\right)^n, n\right)\right\} = 0$$

$$\psi = 1^n + i\left(\frac{1}{n}\right)^n, \ \psi^* = 1^n - i\left(\frac{1}{n}\right)^n \quad ,$$

$$\psi\psi^* = 1^{2n} + \left(\frac{1}{n}\right)^{2n}$$

Note that $rem\left(1^n, \left(\frac{1}{n}\right)^n, n\right)$ cannot be eliminated by conjugation for $n > 2$