The Theory of Special Relativity
(and its role in the proof of Fermat’s Theorem w.r.t. the Binomial Expansion)

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(Always refresh your browser to make sure you have the latest version. This is still a work in progress, although I believe the fundamental concepts to be correct – that said, there are a number of places where there are errors, and I am cleaning those up now. (I did a lot of cutting and pasting..)

If anyone has questions, I will be happy to respond via email ...

There are more topics I want to address in context.)

That is, check your time stamp in the “Updated” line above.

Note: This Document replaces the original document “The Relativistic Unit Circle” I wrote addressing this subject (the original has topics that are not included here, but I think this is clearer. I will be updating this document directly)

Note: many links in my Relativity sections were works in progress, and some are not correct...
These are documents I have written in the heat of battle, and so are not organized into a coherent whole (i.e., a book) and will change as I update them (I’m 79 and may not get to a book). Nevertheless, my perspective is there, and I will respond to intelligent questions about content and philosophy.

(Almost) everything you need to know about the creation of the Universe
(but were afraid to ask).

Prime Numbers (current document in process; includes Goldbach’s conjecture)
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Introduction

The fundamental equation of the Special Theory of relativity \( (ct')^2 = (vt')^2 + (ct)^2 \) for positive real numbers consisting of the field variables \( \{c, v, t, t'\} \) for the single set of real numbers \( \{a\} \) is shown that the metric \( 1_a \) cannot be an integer if subsets of \( \{a\} \) include multiplicative elements with the same metric, and the set of \( \{a\} \) that includes powers of elements of two these subsets are characterized by the Binomial Expansion, which is complete for the real numbers for \( n = 2 \). It is also shown that the equation of a circle is not valid for subsets of \( \{a\} \) since eliminating multiplicative elements requires the introduction of the complex number, which is not a member of \( \{a\} \).

The Binomial Expansion is then invoked for the case \( n > 2 \) where it is shown that Fermat's Expression cannot be valid within the set \( \{a\} \) for positive integers, since there is a remainder factor that cannot be eliminated by subtraction or by invocation of complex numbers, since the variables do not commute as in the case \( n = 2 \).

Einstein’s original theory applied only to positive real numbers for Special Relativity. The General Theory included a complex number in four-dimensional space in the Minkowski metric by attempting to include the three dimensions of space-time (which are irrelevant to the Special Theory). (The Minkowski metric is set to \( r = \sqrt{x^2 + y^2 + z^2} \) then it becomes \( (1, 1) \) corresponding to the Special Theory.

However, the positive half plane of the relativistic unit circle can be characterized as a “creation” vector space – since there are no “destructors”, the multiplicative elements cannot be removed by the prescription \( y^2 = x^2 + y^2 = (x + iy)(x - iy) \) for relativistic momentum and similarly for \( y^4 = x^4 + y^4 = (x^2 + y^2)(x^2 - y^2) \) Fermat’s Expression is valid because the negative half plane is not included in the Binomial Expansion (which is an n-dimensional expansion for two “nomials” in the same plane), and therefore the positive terms in \( \text{rem}([x], [y], n) \) cannot be “destroyed” by their counterparts in the negative half plane. In particular, the proposition that Pythagorean triples belong to the set \( \{a, b, c\} \) is false; rather, they belong to the set that includes a negative number (e.g., \( \{a, b, c, -b\} \)).

(Pythagorean Triples require the negative number as above, and so are not in the set of positive real numbers.

That is, for \( y^2 = c^2 = a^2 + b^2 \) \( \{c, a, b\} \) positive integers

\[ y^2 \notin \{a^2, b^2, c^2\} \]

but rather,
Pythagorean Triples really can be characterized as a Jedi mind trick - the idea that $a$ and $b$ are positive for all real integers in the set $\{a^2, b^2, c^2\}$ is an illusion. This is also true for $n > 2$ (again, by the Binomial Expansion).

That is, for $y^n = c^n = a^n + b^n$  

$y^n \in \{a^n, b^n, c^n\}$

but rather,  

$y^n \not\in \{a^n, b^n, rem(a, b, n), -rem(a, b, n)\}$

And also for the real numbers:

For $y'' = z'' = x'' + y''$, $\{x, y, z\}$ positive real numbers and $^+n$ a real number  

$y''^n \in \{x''^n, y''^n, z''^n\}$

$y''^n \not\in \{x''^n, y''^n, z''^n, rem(x, y, ^+n), -rem(x, y, ^+n)\}$ and for complex numbers:

The Binomial Expansion (Wikipedia)

It really is a Jedi mind trick…. Or I have t long last become a Jedi... J

This is true for both $n > 0$ and $n < 0$, since the integers are a subset within the real numbers. The null vector provides commutativity between two positive real numbers (and is representative of equal and opposite “forces” on the horizontal axis in the final states of two “particles” $(a, b)$) The plane $(x^p, y^q)$ then refers to the product $(x^p, y^q)(0)$ on the upper half of the plane, where $p > 0$ and $q > 0$ for the Binomial Expansion (and thus Fermat’s Expression).

Thus for Special Relativity, the basis set is characterized by $(1,1)$, the Minkowski space by $(1,1,1,1)$ (invoking three “creator” dimensions $\sin(\pi q)$ and a single “destructor” dimensions, whereas the Dirac vector space $(1,1,1,1,1)$ characterized by the $g_{\alpha \beta}$ matrix adds the lower half of the relativistic unit circle as “destructor” operators $\sin(-\pi q)$ so the relativistic unit circle does indeed characterize a circle where $y^2 = x^2 + y^2$ is valid when negative real numbers are included.
It should be emphasized that first order operators characterize momentum, and second order operators characterize energy, so to “destroy” energy, complex operators are necessary as in the Pauli and Dirac formulations \((j_z)^2 = (x + iz)(x - iz) = x^2 + z^2\) and \((j_z)^2 = (y + iz)(y - iz) = y^2 + z^2\) for the complex axis. This is because the interactions between a third axis \((\pm z)\) in the space \((x, y, z)\) must be eliminated for the three dimensions experienced experimentally, so that the three planes \((x, y), (x, z)\) and \((y, z)\) are independent in three-dimensional vector space.

This characterization then forms the foundation of the Standard Model of Quantum Field Theory, where the relativistic final state in three dimensions is characterized by \((0, 0, 0)\) - the three dimensional null vector, and in four dimensions by \((0, 0, 0, 0)\) otherwise known as the Higgs Boson, where Quantum Triviality represents a true Black Hole (there are no “virtual” photons characterized by \(v > 0\) for any of the four dimensions in the mathematical model.

**Summary**

The single valued function \(m_b = c \mathcal{T}\) defines multiplication for all positive real numbers in the Cartesian set \(\{m_b\} = \{c\} \times \{t\}\) where \(m_b, c, t\) are in the set of real numbers defined by the positive real variable \(\{x\}\) so that \(\{m_b, c, t, x\} \rightarrow \{x\}\) is complete under the operation of multiplication \(*\), indicated by juxtaposition of variables \((ct = t.c) \mathcal{F}\ (c \ast t = t \ast c) \rightarrow \{x\}\) and the variables commute under multiplication. \(m_b (c, t) : c, t \rightarrow m_b\) is then a single valued function mapping the two-dimensional Cartesian product into itself, where \(\{c, t\} \rightarrow \{x\}\) so \(m_b \rightarrow \{x\}\).

Similarly, the function \(m_v (v, t') : v, t' \rightarrow m_v\) \((m_v = v \cdot t') \mathcal{F}\ \{x\}\) is complete under the operation \(*\), so that the pair \((vt' = t'v) \mathcal{F}\ m_v \rightarrow \{x\}\) implies that \(\{v, t'\} \rightarrow \{x\}\) so \(m_v \rightarrow \{x\}\).

The power function \(f(x, n) \mathcal{F}\ \{x^n\} \rightarrow \{x\}\) so that \(\{c^n, v^n, t^n, (t')^n\} \mathcal{F}\ \{x\}\) where each constituent is taken to the power of \(n\) \(\mathcal{F}\ \{x\}\) and their products commute (e.g. \((ct^n = t^n c^n) \mathcal{F}\ (ct^n) = (t^n c^n) \mathcal{F}\ \{x\}\).

The single valued function \(j \mathcal{F}\ (m_b + m_v) \rightarrow \{x\}\) is also a positive real number under the sum operation \(+\), so that \(j^n \mathcal{F}\ ((m_b + m_v)^n = (m_b + m_v)^n \mathcal{F}\ \{x\}\) is complete for \(\{c, v, t, t'\} \mathcal{F}\ \{x\}\) under the operations \((+, \ast, n)\) where it is understood that all elements of the set commute under the operations, and the set of positive real numbers is complete under these operations. (he operations \(+\) and \(\ast\) are
binary operations relating independent elements of \( \{x\} \), and the notation \( x^n \) indicates that the multiplication operation is carried out on \( n \) identical elements of \( \{x\} \), \( n \in \{x\} \)

Then the Binomial Expansion is complete in the set \( \{c, v, t, t', k, n, j\} \) for the positive real number \( j \in \{x\} \), where

\[
j^n \notin (m_0 + m_v)^n = \sum_{k=0}^{n} \binom{n}{k} (m_0)^{n-k} (m_v)^k + \text{rem}(m_0, m_v, n) \text{, where} \]

\[
\frac{n!}{k! \cdot (n-k)!} \cdot \binom{n}{k} \cdot (m_0)^{n-k} \cdot (m_v)^k \quad \text{is a positive real integer for integers } n \div x \quad 0 \quad v
\]

characterizes all terms in the expansion that are not \( (m_0)^n \) or \( (m_v)^n \).

Then the function \( Y^n = (m_0)^n + (m_v)^n \) is not complete for any pair \( (m_0, m_v) \in \{x\} \) since it does not include the interaction product \( \text{rem}(m_0, m_v, n) \). That is, for \( Y^n \) to be valid, \( \text{rem}(m_0, m_v, n) = 0 \) for all \( m_0 \in \{x\} \) and \( m_v \in \{x\} \) under the operations \( \frac{n!}{k! \cdot (n-k)!} \cdot \binom{n}{k} \cdot (m_0)^{n-k} \cdot (m_v)^k \) where

\[
\{c, v, t, t', n, k\} \in \{x\} \quad \text{and the set is complete for the positive real numbers.}
\]

However, \( \text{rem}(m_0, m_v, n) > 0 \) for all \( \{c, v, t, t', n, k\} \in \{x\} \), so the expression

\[
Y^n = (m_0)^n + (m_v)^n \quad \text{cannot be valid and in particular } c^n = a^n + b^n \quad \text{(Fermat's Expression), where} \]

\( a \in \{x\}, b \in \{x\}, \quad \text{and} \quad (c \notin Y^\infty \in \{x\} \quad \text{are positive integers within the set } \{x\} \text{ of real numbers.}
\]

This constitutes the proof of Fermat's Theorem, which states \( c^n \cdot d^n + b^n \) for \( n > 2 \), \( \{a, b, c, n\} \in \{x\} \) positive integers within the set \( \{x\} \).

Note that in the Binomial Expansion \( \text{rem}(m_0, m_v, n) = 0 \) implies that \( m_0 = 0 \), \( m_v = 0 \) in which case

\[
j = m_v \text{ or } j = m_0, \text{ or both (in which case } j^n = 0)\]

The case \( n=2 \)

For the case \( n = 2 \), \( j^2 = (m_0 + m_v)^2 = m_0^2 + m_v^2 + 2m_0m_v \), where the factor of 2 arises from the property that \( m_0 \) and \( m_v \) commute under both addition and multiplication. The “interaction” (multiplication) term \( 2m_0m_v \) can be eliminated using the complex conjugate multiplication operation (redefined as \(*\), where \( Y^*Y \notin (m_0 + im_v)(m_0 - im_v) = (m_0)^2 + (m_v)^2 \) where \( i = \sqrt{-1} \) and the
interaction product $m_v^k m_v = m_v m_0$ is added and “subtracted” by the conjugation operation. However, this operation is not within the set of positive real numbers $\{x\}$, so $Y^\ast Y \notin \{x\}$, and in particular the set of positive integers where $(a+b)^2 = (a+ib)(a-ib)$.

**The case $n>2$**

The conjugation operation cannot be used for $n > 2$ since the elements in $m_0^k m_v^{n-k}$ are not interchangeable; that is $m_0^k m_v^{n-k} \neq m_v^{n-k} m_0^k$ so the interaction products cannot be added and “subtracted” for each term. However, they still commute, since $(m_0^k m_v^{n-k} = m_v^{n-k} m_0^k) \in \{x\}$ and are still positive real numbers within the set $\{x\}$. Thus $rem(m_0, m_v, n)$ cannot be eliminated even by conjugation in the case $n > 2$.

**Special Relativity**

The expression $\varphi$ can be characterized as the fundamental equation of the Special Theory of Relativity $(\varphi^2 \equiv \varphi^* \varphi = (c \tau')^2 = (v \tau')^2 + (c \tau)^2)$ for the case $n = 2$ of the Binomial Expansion, where $\alpha \tau$ can be characterized as an initial state, $v \tau'$ as a state of change, and $c \tau'$ as the final state. (Note that if $c = 0$ there is neither an initial state or a final state.), where the multiplicative “interaction” product $2(\alpha \tau)(v \tau')$ has been eliminated from $\varphi^2 = (m_0 + m_v)^2 = (m_0)^2 + (m_v)^2 + 2m_0 m_v$ by the complex conjugation operation $Y^\ast Y$.

The equation $(\alpha \tau)^2 = (v \tau')^2 + (\alpha \tau)^2$ has three solutions;

1. Solving for $\tau'$: $\tau' = \tau g, g = \frac{1}{\sqrt{1-b^2}}, b = \frac{v}{c}, g \ast \{x\}, b \ast x, b^2 < 1^2$ and

$g^2(1-b^2) = g^2 - (bg)^2 < g^2$, valid for all $\{c, v, t, t'\} \ast \{x\}$ under the operations

$\{x \ast x', x \ast x', x' \ast \{x\}\}$

2. The Final State invariant: $(1, \alpha \tau)^2 = \frac{1}{4} \frac{1}{\alpha \tau} \frac{1}{(v \tau')^2 + (\alpha \tau)^2} = b^2 + \frac{1}{4} \cdot \frac{1}{g} \frac{1}{b^2}, 0 \leq b < 1, 0 < g \leq 1$

Note that $\frac{1}{4} \frac{1}{g} = 1^2 - b^2 \leq 1^2$

3. The Initial State invariant: $(1, \alpha \tau)^2 = \frac{1}{4} \frac{1}{\alpha \tau} \frac{1}{(v \tau')^2 + (\alpha \tau)^2} = (bg)^2 + g^2$
Since \( b^2 < 1 \), the system \( \{c, v, t', t''\} \) under the operations \( (x \rightarrow x', x \not{\rightarrow} x', x', x^2) \) can only be an integer if \( b = 0 \), in which case the initial and final states are the same \( ct = ct' \), so that \( (1,1,1) \rightarrow \{x\} \) and \( n > 1 \) \( \rightarrow \{x\} \), where \( n \) is an integer.

Then \( j^2 = -b^2 - b^2 + b^2 \) cannot be an integer for \( 0 \leq b < 1 \), \( 0 < g \leq 1 \).

And \( y^2 = (bg)^2 + g^2 = g^2 (b^2 + 1^2) < 2g^2 \), \( n^2 \) cannot be an integer unless \( b = 0 \), \( g = 1 \).

Therefore, the system characterized by the fundamental equation of Special Relativity can only be an integer if \( t' = t \), which means that \( v = 0 \) and \( \frac{\partial}{\partial t} \rightarrow \frac{\partial}{\partial t} \), \( \frac{\partial}{\partial \tau} \rightarrow \frac{\partial}{\partial \tau} \), \( \frac{\partial}{\partial \tau} \rightarrow \frac{\partial}{\partial \tau} \) so that the initial state is equal to the final state.

**Final State Analysis**

Consider the case \( j(0) = \frac{1}{r} \cdot \frac{1}{r} + b \cdot \frac{1}{r}(0), \quad r = 1 \), so that \( j^2 = \frac{1}{r} + b^2 = \frac{1}{r} + b^2 + 2b \)

where the factor of 2 arises from the fact that \( b \) and \( \frac{1}{r} \) commute under multiplication, and \( b^2 \) and

\[ \frac{1}{r} \text{ commute under addition; i.e. } b \cdot \frac{1}{r} = \frac{1}{r} b \text{ and } b^2 + \frac{1}{r} = \frac{1}{r} b \text{ and } b^2 + \frac{1}{r} = \frac{1}{r} b + b^2 \]

Then for \( y^2 = l^2 = \frac{1}{r} + b^2 \) (the relativistic unit circle – the final state), the term \( b^2 \) must vanish. If \( b = 0 \) then \( y^2 = \frac{1}{r} \), so the equation is independent of \( b \). However, if

\[ y^2 = \frac{1}{r} + ib \frac{1}{r} - ib \frac{1}{r} = \frac{1}{r} + b^2 \]

then the equation forms the relativistic unit circle where

\[ \frac{1}{r} = \cos \theta \text{ and } b = \sin \theta \]

so that \( l^2 = \frac{1}{r} + b^2 = \cos^2 \theta + \sin^2 \theta \) and the interaction term

\[ \frac{b}{r} = \sin \theta \cos \theta \]

is added and subtracted from the equation with the help of the complex unit \( i \).
It is instructive to consider the Binomial Expansion:

\[
\mathbf{j}^n = \frac{a}{g} + b \frac{a}{g} + \frac{a}{g} b^n + \text{rem}(\frac{1}{g}, b, n),
\]

where \(\mathbf{j}^n\) cannot be an integer unless \(b = 0\), \(\frac{1}{g} = g = 1\) so that \(\mathbf{j}^n = 1^n\).

**Final State Analysis**

\[
\left(\frac{c\tau'}{c\tau}\right)^2 = 1^2
\]

\[
\psi^2 = (\gamma^{-1})^2 + \beta^2
\]

\[
\varphi^2 = \left[(\gamma^{-1}) + \beta\right]^2 = \left[(\gamma^{-1})^2 + \beta^2\right] + 2\left(\frac{\beta}{\gamma}\right) = \psi^2 + 2\left(\frac{\beta}{\gamma}\right)
\]

\[
\gamma = \beta = 0
\]

\[
ct = ct' = 0
\]

\[
\gamma = \frac{1}{\sqrt{1 - \beta^2}}, \quad \beta = \frac{v}{c}
\]

\[
\cos \theta = \frac{1}{\gamma}, \quad \sin \theta = \beta
\]

\[
\theta' = \cos^2 \theta + \sin^2 \theta
\]

\[
\mathbf{A}_o = (1)^i, \quad \mathbf{A}_n = 4\left(\frac{1}{2}\right)\frac{\beta}{\gamma} = 2\left(\frac{\beta}{\gamma}\right)
\]
Initial State Analysis

\[
\begin{align*}
\left(\frac{ct}{c}t\right)^2 &= 1^2 \\
\varphi &= 1 + \beta \gamma = \varphi \\
\varphi^2 &= \gamma^2 = 1^2 + (\beta \gamma)^2 \\
\varphi^2 &= \left[1 + (\beta \gamma)^2\right]^2 = \left[1^2 + (\beta \gamma)^2\right] + 2 \beta \gamma = \psi^2 + 2 \beta \gamma
\end{align*}
\]

\[
\begin{align*}
\gamma^2 &= 1^2 + (\beta \gamma)^2 \iff \gamma = \frac{1^2}{\sqrt{1^2 + \beta^2}} \\
A_\varphi &= (1)^2, \quad A_\Delta = 4 \left(\frac{1}{2}\right) \beta \gamma = 2 \beta \gamma \\
\cos \theta &= \frac{1}{\gamma}, \quad \sin \theta = \frac{\beta \gamma}{\gamma} = \beta \\
\cosh \theta &= \gamma, \sinh \theta = \beta \gamma \\
\cosh^2 \theta &= 1^2 + \sinh^2 \theta
\end{align*}
\]
In the case of the initial state \[ \psi_2 = \frac{1}{\sqrt{b}} \psi_1 \]

so that \[ g^2 = \frac{1}{(r^2 - b^2)} \]

for \( g^2 = 1 \) and \( g'' = 1'' \), \( b = 0 \).

In terms of vectors, this equation is actually

\[ j^2 \left( [r \cdot r] \right) = 1^2 \left( [j \cdot i] \right) + (bg)^2 \left( [j \cdot j] \right) + 2bg \left( [k \cdot k] \right) \]

so that

\[ j^2 (0) = \frac{1}{r^2} \psi_1^2 (0) + (bg)^2 (0) + 2bg (0) = \frac{1}{r^2} \psi_1^2 + (bg)^2 + 2bg \frac{3}{3} (0) = \frac{1}{r^2} \psi^2 + 2bg \frac{3}{3} (0) \]

and

\[ j^2 = \frac{1}{4} \frac{1}{r^2} \psi^2 + (bg)^2 + 2bg \frac{3}{3} \]

Setting \( r = 1 \) "resets" the initial state to be the final state for \( b = 0 \) (at which point it can become another initial state if there is a further change... represented by a higher order of \( n \) in the Binomial Expansion.

Note that as \( bg \) increases with \( g \) (i.e., as \( v \to c \)) the effect of the initial condition becomes less and less. The “Continuum” is achieved only at \( g = \bullet \) (e.g. relativistic mass)
Initial and Final States with respect to Dimensions

Final State Analysis

\[ \left( \frac{ct}{ct} \right)^2 = 1^2 \]

\[ \psi^2 = 1^2 + (\gamma \beta)^2 = \gamma^2 \]

\[ \phi^2 = \left[ 1 + (\gamma \beta) \right]^2 = \left[ 1^2 + \gamma^2 \beta^2 \right] + 2 \beta \gamma = \psi^2 + 2 \beta \gamma \]

Initial State Analysis

\[ \left( \frac{ct}{ct} \right)^2 = 1^2 \]

\[ \psi^2 = \left( \frac{1}{\gamma} \right)^2 + \beta^2 = 1^2 \]

\[ \phi^2 = \left[ 1 + \beta \right]^2 = \left( \left( \frac{1}{\gamma} \right)^2 + \beta^2 \right) + \beta^2 = 1^2 + 2 \frac{\beta}{\gamma} \]

\[ \gamma^2 = 1^2 + (\beta \gamma)^2 \iff \gamma = \frac{1^2}{\sqrt{1 - \beta^2}} \]

\[ \cos \theta = \gamma^{-1}, \ \sin \theta = \beta \]

\[ A_{\Delta} = 4 \left( \frac{1}{2} \right) \beta \gamma = 2 \beta \gamma \]

\[ \gamma = \frac{1}{\sqrt{1 - \beta^2}}, \ \beta = \frac{v}{c} \]

\[ \cos \theta = \gamma^{-1}, \ \sin \theta = \beta \]

\[ 1^2 = \cos^2 \theta + \sin^2 \theta = \left( \gamma^{-1} \right)^2 + \beta^2 \]

\[ A_{\Delta} = 4 \left[ \frac{1}{2} \frac{\beta}{\gamma} \right] = 2 \frac{\beta}{\gamma} \]
Note that dividing the expression for the Initial state

\[ g^2 = 1^2 + (bg^2) \]

by \(g^2\) results in the expression for the final state:

\[ \frac{g_f^2}{g_i^2} = \frac{1^2 + b^2}{g_i^2} \]

which is the relativistic unit circle, which is only valid if the initial state is equal to the final state. Then In both cases, \(|g_x| = 1 \Rightarrow b = 0\) which means that \(x|g_x| = x, g_x = 1, b = 0, x\mathcal{J}(c, v, t, t')\) can only be a real number for all \(\{x\}\) in one dimension for \(\{g_f = g_i = 1\}\) for \(x\) a positive real number so that the fundamental equation of Special Relativity is only valid for all real numbers in one dimension for the final state equal to the initial state.

Expanding the expression for the final state by the Binomial Expansion results in:

\[ g_x^n = (1 + bg_x^n)^n = 1^n + (bg_x^n)^n + \text{rem} (1, bg_x^n)^n \]

where \(g_x^n = 1^n \Rightarrow b = 0\) so that

\[ |x|g_x^n(0) = |x|(1^n)(0) = |x|(0) \Rightarrow b = 0 \]

for \(x\) a positive real number so that the fundamental equation of Special Relativity is only valid for all real numbers in one dimension for the final state equal to the initial state.

In particular, this is also true for the real positive single valued number \(c\), where

\[ ct' = ct \Rightarrow t' = t, c = c, \text{ where } c = ci \]

so that

\[ c^2g_x^n(0) = c^2(1^n)(0) = c^2(0) \Rightarrow b^2 = 0 \]

For a second positive real number \(y\) where \(\{c, v, t, t'\} \notin \{y\}\) and

\[ y|g_y| = y, g_y = 1, b = 0, y\mathcal{J}(c, v, t, t'), \]

is modeled by the STR where the final state is equal to the initial state so that

\[ |y|g_y^n(0) = |y|(1^n)(0) = |y|(0) \Rightarrow b = 0 \]

Then \(y = ci + vjx\) for the real number pair \(c, v \notin \{x, y\}\) and if orthogonal (i.e., independent), \(y = c = ci \Rightarrow vj = 0 \Rightarrow v = 0\). If not orthogonal then the Binomial Expansion applies.

For the case \(n = 2\), then

\[ y^2(0) = (x^2 + y^2)(0) = (x + iy)(x - iy)(0) \]

so that

\[ y^2 = (x^2 + y^2) = (x + iy)(x - iy) \]

where the interaction term \(2xy\) in \(j^2 = (x + y)^2 = x^2 + y^2 + 2xy\)

has been eliminated by complex conjugation (which means that the metric \(Y^2 = (x^2 + y^2)\) is not complete for the set \(\{\{x\}, \{y\}\}\), since the product \(\{xy\}\) is not included) (i.e., the metric is that of a Presburger arithmetic, which also is a verification of Gödel’s Theorem). This cannot be accomplished for \(n > 2\), where \(j^n = (x + y)^n = x^n + y^n + \text{rem}(x, y, n)\) since \(x^n y^{n-k} p y^n x^{n-k}\) unless \(k = 0\).
This analysis is the reason that Fermat’s Theorem is valid, and is independent of the integer property.

**Pythagorean Triples and Fermat’s Theorem**

(Note that for Pythagorean Triples in the case $n = 2$, $y^2 = (a^2 + b^2) = (a + ib)(a - ib)$ but that $j^2 = (a + b)^2 = a^2 + b^2 + 2ab$, where the latter is valid without complex conjugation. For $n > 2$, $j^n = (a + b)^n = a^n + b^n + \text{rem}(a, b, n)$ so that for $y^n = j^n$, $\text{rem}(a, b, n) = 0$ (i.e., must vanish) which can only be the case for $a = 0$ or $b = 0$, so that for two positive integers $(a, b)$ Fermat’s Expression $y^n = c^n p a^n + b^n$ is valid for the special case of $y = c$, a positive integer.

**Maxwell’s Result, Relativity, and the Binomial Expansion**

Maxwell achieved his formula for $c^2 = \frac{1}{\varepsilon_0 \mu_0}$ by applying the “dot” and “cross” products via Stokes’ and Greens’ “Space-Time” integrals to area and volume interpretations of charge and current via Gauss’s and Ampere’s (classical) laws. In doing so, he “linearized” space and time by eliminating the full interactions between charge and current. Einstein’s attempt to use differential geometry to restore the non-linearities in concept led to his “field equations” in space and time, where “acceleration” is interpreted as a curvature modification to the orthogonal Galileo/Descartes/Newton space-time frame.

However, such a “gauge change” really results in a change to $\frac{1}{c_0 m_0}$ (Final state analysis) or $(1, gb)$ (Initial State analysis), where the full “nonlinearity” is represented by the Binomial Theorem (which is a model of the integrated elements of the Christoffel symbols in the General Theory). By declaring $c$ to be an invariant, he relegated the observation of the Universe to those we can make in the parking lot, (on the surface of this planet, in this solar system, in this galaxy) which is true to everyone except cosmologists; yet even Einstein persisted (who admitted he was searching for the nature of God.)

Just as the “metric” $y^n = x^n + y^n$ is incomplete with respect to the real numbers, since it doesn’t include the interaction term $\text{rem}(x, y, n)$ and so no multiplicative factors of the form $x^k y^{n-k}$ in the Binomial expansion, the expression $y^n = x^n$ is incomplete because it doesn’t contain any additive terms but is only a multiplication on a single basis element where the initial state is equal to the final state for $x = ct = ct'$

Consider the expansion
$j^2 = \frac{1}{r^3} (e_0 + m_0)^2 = \frac{1}{r^2} \frac{\varepsilon_0}{\mu_0} (e_0^2 + m_0^2 + 2e_0m_0 + \frac{2}{3})$ where $c^2 = \frac{1}{e_0m_0}$ (Maxwell) so that for

$\gamma^2 = (e_0^2 + m_0^2)$ results in

\[ j^2 = \frac{\varepsilon_0}{\mu_0} (e_0 + m_0)^2 = \frac{1}{r^2} \frac{\varepsilon_0}{\mu_0} (e_0^2 + m_0^2) + 2e_0m_0 = \frac{1}{r^2} \frac{\varepsilon_0}{\mu_0} (e_0^2 + m_0^2) + \frac{2}{c^2} \frac{\varepsilon_0}{\mu_0} \gamma^2 + \frac{2}{c^2} \frac{\varepsilon_0}{\mu_0} \gamma^2 \]

Compare this equation with

$\gamma^2 = e_0^2 + m_0^2$ and note that Maxwell’s value (the “interaction term”) $2e_0m_0 = \frac{2}{c^2}$ has been eliminated.

That is, $\gamma^2 = e_0^2 + m_0^2 = (e_0 + im_0)(e_0 - im_0)$ where $e_0 \equiv 0 \equiv 0$.

But then $e_0 \equiv 2m \equiv e \int_0^m = 2e_0m_0 \equiv 0 = \frac{2}{c^2} \equiv m_0c^2 \equiv (0)(0)$, $m_0 = e_0m_0$. 


Final State Invariant

$$\frac{c}{ct'} = 1^2; \ c = g \ m = b \ j^2 = c_{\epsilon}\ \frac{m_0 \ \beta}{e_0 \ b} + b^2 + 2 \ \frac{m_0 \ \beta}{e_0 \ b}$$

$$\text{is the current to charge ratio.}$$

For $$c_0 = m_0$$ and $$m_0 = m'$$, this is equivalent to the relativistic equation $$m' = m_g\beta$$ so that if $$m_0 = c_0$$ there has been no change to the “rest mass” (of light); i.e., the classical magnetic field $$B = 0$$ corresponding to $$b = \frac{v}{c} = 0$$ relativistically.

$$j^2 = (e_0 + m_0)^2 = (m_0)^2 + b^2 + 2 \frac{m_b \ \beta}{e_0 \ b} \ (\text{Binomial Expansion})$$

$$j^n = \frac{m_0 \ \beta}{e_0 \ b} \ \frac{m_0 \ \beta}{e_0 \ b} \ \frac{m_0 \ \beta}{e_0 \ b} \ \frac{m_0 \ \beta}{e_0 \ b} \ \frac{m_0 \ \beta}{e_0 \ b} \ \frac{m_0 \ \beta}{e_0 \ b} \ \frac{m_0 \ \beta}{e_0 \ b} \ \frac{m_0 \ \beta}{e_0 \ b} \ \frac{m_0 \ \beta}{e_0 \ b} \ \frac{m_0 \ \beta}{e_0 \ b} \ \frac{m_0 \ \beta}{e_0 \ b} \ \frac{m_0 \ \beta}{e_0 \ b} \ \frac{m_0 \ \beta}{e_0 \ b} \ \frac{m_0 \ \beta}{e_0 \ b} \ \frac{m_0 \ \beta}{e_0 \ b} \ \frac{m_0 \ \beta}{e_0 \ b} \ \frac{m_0 \ \beta}{e_0 \ b} \ \frac{m_0 \ \beta}{e_0 \ b}$$

$$\text{rem } (e_0, m_0, n) = 0 \ \Rightarrow m_0 = 0 \ (e_0 = 0 \ \Rightarrow m_0 = 0 \ \Rightarrow j = 0)$$

Initial State Invariant

$$\frac{c}{ct'} = 1^2; \ e_0 = 1, \ m_0 = bg \ j^2 = g^2 = \frac{(e_0)^2}{\sqrt{g^2 - (m_0)^2}} \ \Rightarrow g^2 = (e_0)^2 + (m_0)^2$$

$$\text{(Binomial Expansion)}$$

$$j^n = \frac{m_0 \ \beta}{e_0 \ b} \ \frac{m_0 \ \beta}{e_0 \ b} \ \frac{m_0 \ \beta}{e_0 \ b} \ \frac{m_0 \ \beta}{e_0 \ b} \ \frac{m_0 \ \beta}{e_0 \ b} \ \frac{m_0 \ \beta}{e_0 \ b} \ \frac{m_0 \ \beta}{e_0 \ b} \ \frac{m_0 \ \beta}{e_0 \ b} \ \frac{m_0 \ \beta}{e_0 \ b} \ \frac{m_0 \ \beta}{e_0 \ b} \ \frac{m_0 \ \beta}{e_0 \ b} \ \frac{m_0 \ \beta}{e_0 \ b} \ \frac{m_0 \ \beta}{e_0 \ b} \ \frac{m_0 \ \beta}{e_0 \ b} \ \frac{m_0 \ \beta}{e_0 \ b} \ \frac{m_0 \ \beta}{e_0 \ b}$$

, where $$j^n \ \# 1^n, \ j^n = (e_0)^n \ \Rightarrow e_0 = 1, \ m_0 = 0 \ \Rightarrow \text{rem } (e_0, m_0, n) = 0, \ r = 1$$
**The Initial and Final States of the Universe**

Let \( \mathbf{f} \) be the state of a photo-equivalent system (Universe) characterized by its initial and final states, where \( m_0 = ct = h \). Let \( \mathbf{j} = \frac{ct}{\mathbf{b}} = 1 \) be the basis for the system \( (\mathbf{j}, y) \) where the initial state is taken to be invariant, and \( \mathbf{y} = \frac{ct}{\mathbf{b}} = 1 \) be the basis for the system \( (\mathbf{j}, y) \) when the final state is taken to be invariant.

\[
\mathbf{f}^k = \frac{1}{\mathbf{j}_{xy}} \left( \mathbf{j}^n + \mathbf{y}^n \right)^k = \frac{1}{\mathbf{j}_{xy}} \left( \left( \mathbf{j}^n \right)^k + \left( \mathbf{y}^n \right)^k + 2 \left( \mathbf{j}^n \right)^k \left( \mathbf{y}^n \right)^k \right)
\]

so that

\[
\mathbf{f} = \frac{1}{\mathbf{j}_{xy}} \left( \mathbf{j}^n + \mathbf{y}^n \right) = \frac{1}{\mathbf{j}_{xy}} \left( 1 + \mathbf{y}^n \right)^n = \frac{1}{\mathbf{j}_{xy}} \left( 1 + \mathbf{y}^n \right)^n + \text{rem}(1, \mathbf{y}^n, n)
\]

Then for \( k \) such systems of order \( n \),

\[
\mathbf{f}^k = 1^k \geq r_{xy} = 1^k \text{ and } \frac{1}{\mathbf{j}_{xy}} \left( 1 \right)^n = 0 \text{ or } \frac{1}{\mathbf{j}_{xy}} \left( 1 \right)^n = 0 \text{ or both, in which case } \mathbf{f}^k = 0 \text{ which is a division by zero (that is, the dimension } r_{xy} \text{ is undefined), so that for the “universe” to exist, either }\]

\[
\mathbf{j} = \frac{ct}{\mathbf{b}} = 1 \text{ or } \mathbf{y} = \frac{ct}{\mathbf{b}} = 1 \text{ must exist (either an initial or a final state must exist, or there is no universe). (If } \mathbf{j} = \mathbf{y} \text{ then the initial and final states are the same, of course.)}
\]

Which is actually “true” is a question of religion, naïve solipsism or naïve realism (The Universe doesn’t measure itself), since \( \mathbf{j} \) and \( \mathbf{y} \) include all possible existing states (“imagined” as positive real numbers) w.r.t. the Binomial Theorem, where the Binary elements are the positive real numbers systems that model the initial and final states (the “Wow” and “Ow” of physics, where together with our subjective imagined/imposed) coordinate systems comprise the “Tao” of physics, where

\[
(Tao)^n = (Wow)^n + (Ow)^n + \text{Re } m(\text{Wow, Ow, n})
\]
(Note that the ratio $\frac{db}{dg}$ is a definition of the derivative consistent with the Final State of the Universe, and is analogous to the Christoffel symbols of differential geometry)

**Comment**

The reason that the proof of Fermat’s Theorem works is because in the Final State solution $\frac{\partial^2}{\partial c^t \partial v^t} = 1^2$ for the case $n = 2$ the "rest mass $c^t$ and "perturbation" $v^t$ commute; that is which is which is a mere question of labeling for $\{c, v, t, t'\} \ni \{x\}$ real numbers, with no physical interpretation. This is not true if the initial state $\frac{\partial^2}{\partial c^t \partial v^t} = 1^2$ because now there is a sign (parity) distinction between $c^t$ and $v^t$.

For the case $n = 2$ the expansion to the Binomial Theorem is a reflection of the requirement that $x$ and $x'$ (i.e., $y$) are not independent if both additive $(x + y) = (y + x)$ and multiplicative $xy = yx$ are required to define the positive real numbers. For the case $n = 2$ it is possible to circumvent this requirement by complex conjugation $y^2 = (x + iy)(x - iy) = x^2 + y^2$ as contrasted with $j^2 = (x + y)^2 = (x^2 + y^2) + 2xy = (x^2 + y^2) + 2yx$ but in the higher powers of the Binomial Expansion the variables are not interchangeable $\mathfrak{rem}(x, y, n)$ and so cannot be eliminated by conjugation.

That is, in the equation $y^2 = (x + iy)(x - iy) = x^2 + y^2$ there is no distinction between which is the initial state and which is the "perturbation" if the final state is taken to be the basis for the dimension.

If the initial state is taken as the basis for the dimension, then two dimensions are required, but the final state also includes multiplicative interaction between the initial state and the perturbation $2y \not\equiv 2m_0m_\nu$. If it does not, then Fermat’s expression is the basis for a Pressburger arithmetic that does not include multiplication, and so is incomplete (which is true even for $n = 2$, since conjugation is required for linearity) so that $x(1^2) = x(\cos^2 \theta + \sin^2 \theta)$ in the case $\frac{\partial^2}{\partial c^t \partial v^t} = 1^2$ which does not hold for the case $\frac{\partial^2}{\partial c^t \partial v^t} = 1^2$ where hyperbolic function are required for linearity.
Conclusions

1. The analysis of the real number system in terms of the Fundamental Equation of Special Relativity shows there can be only one basis for each complete real number system.

2. If a real number is “re-ified” (i.e. is an invariant), the relationships within each dimension are described in terms of multiples of its basis vector.

3. For distinct (“re-ified”) real number systems, the relations between invariants between dimensions is characterized by the Binomial Theorem (for two systems) and by the Multinomial Theorem for multiple systems.

4. Calculus and classical “curvature” does not apply to reified systems, either in GTR or STR for more than one dimension.

   a. Consider the Binomial expansion of $\phi^n = (1 + h)^n$ and note that $\lim_{h \to 0} (1 + h)^n = 1^n$; then substitute a real (“re-ified”) number for the unit integer.

   b. Wiles’ proof cannot be correct, since it postulates “elliptic curves” at the start; these curves cannot be eliminated (by conjugation) in the one dimension $n > 2$, and even for $n = 2$ the elimination requires the introduction of complex numbers (“subtraction”), so cannot be relevant to a system of positive “re-ified” real numbers. At the very least, it must be isomorphic to the Binomial Expansion.

   c. The classical description of the derivative is an expression that “re-ifies” real number variables: $f'(1) = \lim_{h \to 0} \frac{f(1 + h) - f(1)}{h} = 0$, and so is a tautology in two dimensions, corresponding the invariance of the Fundamental Theory of Relativity in the case that the initial state is equal to the final state.

   d. Fermat’s Expression: $y^n = a^n + b^n$ is an expression in two dimensions (replace b by h and take the limit as in (4.) above. The Binomial Expression is $\phi^n = (a + b)^n = a^n + b^n + \text{rem}(a, b, n) = y^n + \text{rem}(a, b, n)$. For Fermat’s expression to be valid $\text{rem}(a, b, n) = 0$ which is only true in the limit $b = 0$. Fermat’s Expression can be recovered from the Binomial Theorem by complex conjugation: $(y^n)^2 + (\phi^n)^2 = (y^n + i\phi^n)(y^n - i\phi^n)$ only by setting $\phi^n = 0$, in which case the equation is a tautology in one dimension (i.e., $b = 0$).

   e. This is the reason calculus cannot be applied (except as an approximation) to either QFT or GRT, since it requires taking the derivative of a (constant, “re-ified”) real number in the final analysis,
5. The fundamental equation of Special Relativity:

\[
(ct')^2 = (vt')^2 + (ct)^2
\]

Describes the transition from an initial state to a final state via a perturbation for a positive definite real number system, but does not include the interaction between the initial state and the perturbation, and so is incomplete for \( \{c,v,t,t'\}_x = \{x\} \). If \( c = 0 \), neither the initial or the final state exists.

a. There are three solutions to the fundamental equation of STR

   a. Solution in terms of scaling factor

   \[
   t' = t \gamma, \quad g = \frac{1}{\sqrt{1 - b^2}}, \quad b = \frac{v}{c}
   \]

   b. Solution in terms of final state invariant

   \[
   y^2 = \frac{c t'}{c t' + b} = \frac{1}{g_{\text{final}}} + b^2, \quad l^2 = \frac{1}{g_{\text{final}}} + b^2 = \cos^2 q + \sin^2 q, \quad \text{where } l^2 \text{ represents the “area” of the relativistic unit circle, where } \cos q = \frac{1}{g}, \text{ and}
   \]

   \[
   \sin q = b
   \]

   c. Solution in terms of initial state invariant

   \[
   y^2 = \frac{c t}{ct} = l^2 + (gb)^2, \quad g^2 = (1)^2 + (gb)^2, \quad \cos q = 1, \quad \sin q = bg, \quad \text{and}
   \]

   \[
   g^2 = \cosh^2 q = l^2 + \sinh^2 q
   \]

b. If the initial state is equal to the final state \( y = y \) and \( g = g = |l| \), there is no perturbation, since \( b = \frac{v}{c} = 0, v = 0 \)
The Binomial Theorem in both the initial and final state characterizations is given by

\[ n \binom{n}{k} = \frac{n!}{k!(n-k)!} \]

where \( \binom{n}{k} \) is the binomial coefficient.

1. **Case \( n = 2 \)**

   The Binomial Theorem for \( n = 2 \).

   \[ j^2 = x^2 + y^2 = (x + y)^2 = x^2 + 2xy + y^2 \]

   \[ j^2 = (y^2 + 2b + (y^2 + 2b) = (y^2 + 2b) = y^2 + 2b \]

2. **Case \( n = 3 \)**

   The Binomial Theorem for \( n = 3 \).

   \[ (j^2)^2 = (y^2)^2 + 2b = (y^2)^2 + 2b \]

   \[ (j^2)^2 = (y^2)^2 + 2b = (y^2)^2 + 2b \]

3. **Case \( n = 4 \)**

   The Binomial Theorem for \( n = 4 \).

   \[ (j^2)^2 = (y^2)^2 + 2b = (y^2)^2 + 2b \]

   \[ (j^2)^2 = (y^2)^2 + 2b = (y^2)^2 + 2b \]

The terms in each case commute, but the terms for \( n = 2 \) and \( n = 3 \) commute and can be interchanged w.r.t. the complex element. However, for \( n > 2 \) and \( n = 4 \), the terms do not commute and can only be applied for \( n = 2 \).

The set of all real numbers is complete for the single dimension \( x = xi \) for the case \( n = 2 \).
\( \sum_{k} \left( \frac{n}{k} \right)^{i} (bg)^{-k} \sum_{k} \left( \frac{n}{k} \right)^{j} (bg)^{-k} (1)^{k} \), so cannot be interchanged, so the term \( \text{rem}(x, y, n) \) cannot be eliminated by conjugation in either the initial or final state representation.

e. In classical Quantum Mechanics, \( h = 2 \) and \( h = 2bg \), respectively, and \( h = h = 1 \) in the Schrödinger equation; \( b = 0 \Rightarrow h = h = 0 \), which implies the QM “wave” equation is irrelevant to classical mechanics and electromagnetism (where there is no light/mass interaction), and where \( g \) represents mass and \( b \) represents charge in both the initial and final cases. If there is no charge, then the mass \( ct' = ct = m_0 \) is invariant.

1. For the final state analysis \( \left( \frac{ct'}{ct} \right)^{2} = 1^{2} \), this is the equivalent of

\[
\frac{1}{g} \cdot b = b \left( |j \cdot j| \right) = 0 . \text{ However, } \frac{1}{g} \cdot b = 2 \frac{b}{g} \left( |i \cdot f| j \right) = 2 \frac{b}{g} (0) , \text{ so that }
\]

\[
\frac{1}{g} \cdot f \cdot b = 2 \frac{b}{g} \text{ represents the interaction between the elements } \left( \frac{1}{g}, b \right) .
\]

2. For the initial state analysis \( \left( \frac{ct}{ct} \right)^{2} = 1^{2} \), this is the equivalent of

\[
|1 \cdot (bg)| = (1)(bg) \left( |i \cdot j| \right) = 0 . \text{ However, } 1 \cdot f \cdot bg = 2(bg) \left( i \cdot f\right) = 2bg (0) , \text{ so that } |1 \cdot f \cdot gb| = 2bg \text{ represents the interaction between the elements } (l, gb) .
\]

3. \( y = y = |l| \Rightarrow b = b = 0 \text{ and } j = j = |l| \Rightarrow b = b = 0 \text{ so that } j = j = y = y = g = g = |l| \Rightarrow b = b = 0 \)

The initial state analysis and the final state analysis for the single variable \( x \) in the real number system \( (c, v, t, t') = \{x\} \) is complete.

The integer \( a \) for \( n \) equivalent systems is defined by

\[
a = (j_{i, k, \ldots})_a = \left( \frac{g_{i}}{g_{j}} \right) + \left( \frac{g_{k}}{g_{j}} \right) + \ldots , \left( \frac{g_{a}}{g_{j}} \right) \Rightarrow \frac{a}{i} \cdot g_{i} , \text{ so that } b = b = b = \ldots , b = 0, \text{ so that }
\]

\[
a'' = (j_{i, k, \ldots})'' = \left( \frac{g_{i}}{g_{j}} \right) \Rightarrow \frac{a''}{i} \cdot g_{i} , \text{ so that } b = b = b = \ldots , b = 0
\]
The integers \( a \{a(1)\} \uparrow \{x\} \) are a subset, and all integers represented by \( a \) are included in the set, so the set \( \{a\} \) is complete in the single dimension \( x = xi \).

A similar analysis for the single variable \( y \) in the real number system \( \{c, v, t, t^*\} \) is \{\( y \}\}, and is therefore complete. The integers \( b \{b(1)\} \uparrow \{y\} \) are a subset, and all integers represented by \( a \) are included in the set, so the set \( \{b\} \) is complete in the single dimension \( y = yi \).

Then the Binomial Expansion \( j^n = (a + b)^n = a^n + b^n + \text{rem}(a, b, n) \) is complete for the two sets \( \{a\}, \{b\} \uparrow \{\{x\}, \{y\}\} \), which includes the interaction term \( \text{rem}(a, b, n) \uparrow \text{rem}(x, y, n) \).

For the case \( n = 2 \) the interaction term \( 2ab \) can be eliminated by conjugation, so that \( j^2 = c^2 = a^2 + b^2 = (a + i b)(a - i b) \) only if conjugation is applied, where
\[
\begin{align*}
\text{c}^2(\text{r}^*\text{r}) &= \left| (a + b)(a + b) \right| = a^2 \left( |j|^2 \right) + b^2 \left( |j|^2 \right) + \left( 2ab \right) \left( |j| \right) \\
\left| (a + b)(a + b) \right| &= a^2 (0) + b^2 (0) + (2ab)(0) \\
\text{c}^2 &= \frac{1}{r^2} a^2 + b^2 + (2ab)
\end{align*}
\]

where \( c = cr = a + b j + (\sqrt{2ab}) k \) so that \( c \) is not an integer unless \( a = 0 \) or \( b = 0 \), in which case \( r = 1 \), and \( c = b \) or \( c = a \), respectively.

Therefore, \( j^2 = c^2 = a^2 + b^2 \) is not complete; for it to be valid the remainder term \( \text{rem}(a, b, 2) = 2ab \) in \( j^2 = c^2 = (a + b)^2 = a^2 + b^2 + 2ab \) would have to vanish, which requires the introduction of complex numbers. In the case \( n > 2 \), the remainder term can never vanish, and \( \text{rem}(a, b, n) > 0 \) in all cases.

Since \( j^n = a^n + b^n \) and \( j^n = (a + b)^n = \sum_{k=0}^{n} \binom{n}{k} a^{n-k} b^k = \sum_{k=0}^{n} \frac{n!}{k!(n-k)!} \), where \( j^n \) is an integer only if \( b^{n-k} = 1 \) which can only happen for \( (n - k) = 0 \Rightarrow n = k \), so that \( j^n = a^n \) (or symmetrically for \( b^n \), so Fermat’s expression \( j^n = a^n + b^n \) can never be true in a system with two complete sets of integers \( \{a\} \uparrow \{b\} \uparrow \{x\} \uparrow \{y\} \), since it requires complex conjugation \( i = \sqrt{-1} \) where \( \{ix\} \uparrow \{x\} \) or \( \{iy\} \uparrow \{y\} \) for the case \( n = 2 \) and the application of \( i \) cannot be eliminate \( \text{rem}(x, y, n) \) for \( n > 2 \) in any case, since the variables in that term cannot be exchanged, even though they commute.
For the general case of the Binomial Expansion,

\[ \mathbf{j}^n = \left( \frac{1}{g} + b \right)^n = \sum_{k=0}^{n} \binom{n}{k} \left( \frac{1}{g} \right)^{n-k} b^k \]

where \( \binom{n}{k} = \frac{n!}{k!(n-k)!} \) is the binomial coefficient.

Thus, \( \mathbf{j}^n = 1^n \Rightarrow b = 0 \) so that \( \mathbf{j} = \mathbf{1} \)

In the case of \( h = bg \) (where \( h^2 = 2v \) characterizes spin, (as opposed to \( \frac{m}{c} = b \) characterizing the charge to mass ratio, or the current to static charge ratio), the expansion becomes

\[ \mathbf{j}^n = \frac{1}{g} + (gb)^2 \]

where \( h = 0 \Rightarrow \mathbf{j} = \mathbf{0} \); i.e. which means that

\[ h = ct = m_0 = \frac{t}{m_0 e} = 0 \Rightarrow t = 0, \ m_0 e_0 \mathbf{p} = 0 \] and \( h = 0 \Rightarrow c = \mathbf{e}, \mathbf{t} \mathbf{p} = 0 \)

(whether \( \mathbf{t} \) represents subjective “time” is up to the imagination; recall that none of the parameters \( (c, v, t, t') \) are parameterized in physical terms since none are invariant (unless declared so by Einstein).
The conventional definition of the derivative for the Theory of Special Relativity for the case $n = 2$ should therefore be envisioned as

$$f'(l^2) = \lim_{h \to 0} \frac{f(l^2 + h) - f(l^2)}{h},$$

where $l^2 = \frac{1}{g^2} + \frac{b^2}{\beta^2}$ or $l^2 = g^2 + (bg)^2$ where both require that $h \to 0$.

$$f'(l^2) = \lim_{h \to 0} \left( \frac{f(1^2 + \beta^2) - f(1^2)}{\beta^2} \right)$$

and

$$f'(l^2) = \lim_{h \to 0} \left( \frac{f(1^2 + g^2) - f(1^2)}{g^2} \right).$$

where $f'(l^2) = f'(g^2) \equiv b = b = 0$ (i.e., an invariant “Black Hole”); that is, $\lim_{b \to 0} \lim_{g \to 0}$. 
Initial Proof of Fermat’s Last Theorem

Fermat’s Theorem: \( c^n \neq a^n + b^n \) for \( a, b, c \) and \( n \) positive integers.

(The presumption that the Fermat’s Theorem hasn’t been proved seems to me to be either a scam by Math Departments worldwide of a Jedi mind trick. If neither the Jedi or the Math Departments understand relativity, then they need to read this pdf…)

The Binomial Theorem

The Binomial Expansion is given by the equation:

\[
(x + y)^n = \sum_{k=0}^{n} \binom{n}{k} x^{n-k} y^k,
\]

where \( \binom{n}{k} = \frac{n!}{k!(n-k)!} \) is a positive integer taken to be the binomial coefficient. I use the expression \( \text{Rem}(x, y, n) = \sum_{k=0}^{n} \binom{n}{k} x^{n-k} y^k - (x^n + y^n) \) to indicate those terms in the Binomial Expansion not equal to either \( x^n \) or \( y^n \).

The Binomial Expansion applies to integers as well as real numbers (in fact, it was first formulated this way), so using \( a \) and \( b \), the expression is given by:

\[
\sum_{k=0}^{n} \binom{n}{k} a^{n-k} b^k
\]

Setting this expression equal to an arbitrary integer \( c^n \) so that

\[
c^n = \sum_{k=0}^{n} \binom{n}{k} a^{n-k} b^k = (a + b)^n = a^n + b^n + \text{Rem}(a, b, n),
\]

where

\[
\text{Rem}(a, b, n) = \sum_{k=0}^{n} \binom{n}{k} a^{n-k} b^k - (a^n + b^n) = m,
\]

and where \( m > 0 \) (is a positive integer) proves Fermat’s Theorem by inspection, since \( c^n p a^n + b^n \)

\[
y^n = a^n + b^n \quad \text{(Fermat’s Expression)}
\]

\[
j^n = (a + b)^n = a^n + b^n + \text{rem}(a, b, n) \quad \text{(Binomial Expansion)}
\]

\[
\text{rem}(a, b, n) > 0 \quad \text{always (including } n = 2 \text{)}
\]

\[
y^n p j^n \quad \text{Q.E.D. (unless the Binomial Expansion is false)}
\]
(The relativistic analysis shows that positive multiplication is defined by the Binomial Expansion for real numbers, and is thus true for all positive real numbers).
A Brief Prologue

Clerk Maxwell (together with Michael Faraday) had produced an expression for the speed of light as

\[ c = \frac{1}{\sqrt{\varepsilon_0 m_0}} \]

where \( \varepsilon_0 \) and \( m_0 \) are the experimental permittivity and permeability constants from Ampere’s and Coulomb’s force laws, with the relation derived by using the concept of displacement current and symmetry relations in Greens’ and Stokes’ representation of space-time areas and volume relationships.

The failure of the M-M experiment to detect any change in \( c \) with respect to position on the surface of the earth, at various aspects of earth orbit and rotations (as well as rotations of the apparatus led Lorentz to produce a transformation (the Lorentz Transform) on space and time in two dimensions:

\[ x' = (x - vt)\gamma \]
\[ t' = (t - \frac{vx}{c^2})\gamma \]

where, \( \gamma = \frac{1}{\sqrt{1 - \beta^2}} \), \( \beta = \frac{v}{c} \)

which is a solution to the equation \( \gamma(x - vt) = c(gx - bt) \) together with the assumption that \( x = ct \Rightarrow x' = ct' \) as a way of accounting for the null result by a “contraction” of the arm directed into the supposed flow of the ether.

If one uses the latter assumption with respect to these equations by substituting \( ct' = x' \) and \( x = ct \) in the first equation, one arrives at the single equation:

\[ ct' = (ct - vt)g = (c - v)(\frac{g}{\gamma}) \text{ or } x' = (x - vt)g = (x - b c)g \]

This was unsatisfying theoretically at the time, because no-one could think of a reason why such an arm would contract, but it did provide consistency with the null results.

The introduction of the Special Theory of Relativity by Albert Einstein provided a linear solution that was consistent with Maxwell’s symmetries in space-time as well as the null results of the MM experiment, and consistent with the wave concepts of Quantum Theory via Planck’s constant. In order to do this, Einstein altered the Lorentz transform, and eliminated Maxwell’s equations by providing a solution that was valid for any value of \( c \) in relation to any motion through an “ether” by insisting that the relation \( b = \frac{v}{c} \) be preserved in terms of what he called “inertial frames”. Again, it is important to stress the concept of “inertia” as contrasted with the Galilean/Newtonian concepts of velocity and mass in a Cartesian coordinate system.
Einstein’s solution was to alter the Lorentz transform by setting \( v = 0 \) in the numerator (eliminating Newton’s momentum \( P = mv \) as a classical motion in space and time), but retaining energy in the denominator: \( b^2 = \frac{mv^2}{mc^2} = \frac{v^2}{c^2} \).

This results in the so-called “time-dilation” equation, \( t' = \gamma t \); however, it should be noted that since \( \gamma \) and \( m \) are not involved explicitly, \( t \) cannot be interpreted in terms of the Newton/Galileo model. He also eliminated any spatial change by setting \( x' = x \), so that the result can be purely addressed in terms of the set of field variables \( \{ c_a, v_a, t_a, t'_a \} \) for a single system \( a \).

The single system \( a \) (The Fundamental Equation of STR)

Einstein made two fundamental assumptions. The first is that the speed of light \( c \) be independent of any velocity of an either, so that they could be related in a coordinates system in two dimensions \((c, v)\). The second assumption was that such a law had to be valid for any relation of the two variables, which can be accomplished by the scalars \( t \) and \( t' \), so that a new coordinate system \((ct, vt')\) is then established, with \( ct \) and \( vt' \) independent of each other (e.g. on orthogonal axes). Since two dimensions are introduced, they can be related by the Fundamental Equation of Special Relativity:

\[
(ct')^2 = (vt')^2 + (ct)^2
\]  

(1.1)

It is instructive to think of this equation as that of relating an initial state \((s_0 = ct)\) to and independent change of state \((Ds = vt')\) resulting in a final state \((s_1 = ct')\) without any contextual interpretation if the set of positive variables \(\{ c_a, v_a, t_a, t'_a \} \) \# \(\{ c, v, t, t' \} \) for a single positive real number system \( a \), so that

\[
(s_1)^2 = (Ds)^2 + (s_0)^2
\]  

(1.2)

(w.r.t. STR, the variables in the set \(\{ c, v, t, t' \} \) are sometimes called “proper” to distinguish them from “space-time” variables in Galilean coordinates.)

However, the variables \( c \) and \( v \) can be interpreted as widget creation rates, with \( t \) and \( t' \) representing widget creation times for a general relation involving a widget change from an initial condition \( ct \) (a “rest” widget) to a final widget \( ct' = (ct)_g \) via a perturbation \((vt')\) with the understanding that the “final state” can then become an initial state of a second process.

(Note: a widget can either be real or figments of the imagination. For integers, the widget must be invariant. Wheeler refers to the widgets as “bits”.)
The Three Solutions of the Fundamental Equation of STR

There are three possible solutions of equation (1.1):

1. Solving for $t'$ which gives the “time dilation equation

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

2. Final State solution: Interpreting the equation in terms of the final state by dividing both sides by $(ct')^2$, with the result:

$$\left(1_\mu^2\right)^2 = b^2 + \frac{1}{4} \left(\frac{b}{g}\right)^2, \text{ which is the equation of the relativistic unit circle.}$$

Any increase in any of the parameters $\{c, v, t, t'\}$ will increase the value of the final state of the widget represented by the constant $1_\mu$, so the number “density” of the system will increase.

3. Initial State solution: Interpreting the equation in terms of the initial state by dividing both sides by $(ct)^2$, with the result:

$$\gamma^2 = \frac{1}{r^2} + \left(\frac{bg}{3}\right)^2, \quad g = \frac{1}{\sqrt{r^2 - \beta^2}},$$

where the $r$ is the resultant of the vector characterization.

Any increase in any of the parameters $\{c, v, t, t'\}$ will increase the value of the initial state of the widget represented by the constant $1_\mu$, so the total number represented by the system $1_\mu$ will increase by the factor $bg$.

Note that if $b = 0, v = 0$, then $t' = t$, and the Initial state is the same as the Final state

$$(g^2 = \frac{1}{g^2} = 1_\mu^2).$$

Therefore, at $v = 0$, there is no “change” in the widget, and the total system is characterized by $ct = ct'$. If $c = 0$ there is no widget.

Physics Interpretations

In the following, it is important to remind the reader that both mass and charge are positive in this context.

Mass and Charge
If \( b \) represents charge (i.e., electromagnetic “light”) and \( g \) represents mass, then increasing will increase both their values, and \( \frac{b}{g} \) represents the charge to mass ratio. If there is no charge, there is no light and the total system is mass (\( g = 1, b = 0 \)). If there is no mass, there is only light \( g = 0, b = 1 \).

If there is no light and no mass, there is nothing.

(Mass and Mass change)

If \( g \) represents the initial mass of a gravitating state and \( b \) represents a change to that state, then the gravitational change will be given by \( m' = mg \). If \( v = 0 \) there is no change \( m' = m_0 \), which represents the initial state. If there is no initial state, there is nothing.

(Light and Light Change)

Here the initial state is represented by Planck’s constant where \( E = \hbar n = \frac{\hbar c \nu}{\lambda} = \frac{\hbar}{t}, Et = h, \) so that

\[ Et' = \hbar t', \quad E_0' = \hbar \nu, \quad t = t' \]

so \( h \) is the initial energy of light for \( E_0 = m_0 c^2 = h, \frac{t}{t} = 1, v = 0 \) Any change will be given by \( E_0' = (m'g) c^2 = hg \), where the change in any of the parameters \( \{ c, \nu, t, t' \} \) will change the energy of the system (characterized as a single photon, or photo-equivalent mass of an electron. That is, if \( c = 0 \) there is no light.

Mathematical Interpretation

The subscript on \( 1_a \) indicates that it can serve as a vector basis for the system, since \( x = x1_a \) for all possible field variables \( x \) as scalars (including integers where \( n = n(1_a) = ni \)

Therefore \( b = 0 \) characterizes a condition of “no change” so that \( 1^2 \) characterizes the state of our local system at any given place and location of where we are as “observers”; i.e., our local instantaneous position in space-time where there is no change \( v = 0 \) even though we exist; i.e. \( ct > 0 \). If \( ct = 0 \), there is no initial state, so no change relative to the nonexistent initial state, so no final state in terms of the nonexistent initial state and relative change.

In particular note that changing \( c \) or any of the other field variables in the set \( \{ c, \nu, t, t' \} \) does not change the form of the equations (1.1) through (1.5), since they are valid for all possible values of the field variables (positive real numbers).

These solutions will be discussed in the following sections, and form the foundation of Quantum Field Theory.
A Second System b

A second independent system b can be created from an independent set of field variables \( \{ c_b, v_b, t_b, t'_b \} \neq \{ c, v, t, t' \}_b \), resulting in a new basis vector \( m = m(1_b) = mi \) where, of course, \( m \) can be equal to \( n \) or not; the number sets for each coefficient are complete independently.

Then if the Initial and Final states of the system \( b \) are the same \( \{ \mathbf{g}_b^2 = \frac{1}{g_b^2} = 1_{b'}^2 \} \), but the field variables may be completely different from that of system \( a \). The two independent systems can then be characterized in the two-dimensional vector Cartesian plane \( (a, b) \) with basis vectors \( (1, 1_b) \neq (i, j) \).

Galilean Space-Time

In a Galilean frame, the relation between time and distance is given by the velocity \( v = \frac{x}{t} \), with Newton’s laws of motion (momentum and kinetic energy) given by \( P = mv \) and \( E = \frac{1}{2}mv^2 \), which are consistent with the rules of differentiation and integration of the Calculus. The Galilean coordinates can be characterized by a Galilean “space time diagram”:

The Galilean concept of velocity was incorporated by Newton in his Laws of Motion:
\[ P = mv \quad \text{and} \quad E = \frac{1}{2}mv^2, \] and are the foundation of Classical kinematics.

\[ \text{Galileo vs STR} \]

The Special Theory of Relativity (STR) interprets the coordinates in terms of widget “mass” and “energy”, rather than time and space, with reference to “inertial frames”, rather than “space-time” frames.

If the Galilean space variables from \( x_v = vt_v \) and \( x_c = ct_c \) are set equal in (e.g.)

\[ b, = \frac{v}{c} = \frac{x_v}{t_v} \quad \text{or} \quad t_c = \frac{x_c}{v}, \quad t_v, \# \quad t_v > 0, \text{ but it must be understood that } b \text{ appears as a second order quantity } \]

\[ b^2 = \frac{v^2 \#}{c} \quad \text{for any arbitrary mass } m. \] It is therefore natural to associate

\[ m_b = ct, \quad m_v = vt \quad \text{and} \quad m' = m_bg \quad \text{from which the relativistic energy equation follows:} \]

\[ \gamma m' c^2 = [Pc]^2 + (m_c c^2)^2 \]

Therefore, \( t \) and \( t' \) appear as scaling factors on widget “mass”: \( m' = ct' = (ct)g = m_bg \), so that \( g \) is interpreted as a change in mass density determined by \( b = \frac{v}{c} \), where \( v \) and \( c \) are to be interpreted in terms of mass creation rates rather than a Galilean space-time “speed”. A change in density will mean that a photon traveling through a medium at speed \( v = bc \) other than a vacuum will travel a shorter distance than a photon “in vacuo” at \( c \), or equivalently, a photon will take a longer time to travel the same distance as a photon “in vacuo” at \( c \), but the relation is a function of \( g \) rather than being simply linear.

This interpretation is shown in the diagram below, with “contraction” and “dilation" increasing with

\[ b = \frac{v}{c} \quad \text{That is, the medium becomes more dense as } b \text{ increases, and, as } b \text{ decreases, the photon will take less time to travel the distance } x_v = x_c \]
In order to understand “Length Contraction” and “Time-Dilation”, it is instructive to deconstruct \( \beta \) in terms of its Galilean space-time components \( \beta = \frac{v}{c} = \frac{x_v}{t_v x_c} \) in the “time-dilation” equation

\[
\tau' = t\gamma, \quad \gamma = \frac{1}{\sqrt{1 - \beta^2}}, \quad \beta = \frac{v}{c}, \quad t_v > 0,
\]

where it is now understood that \( t \) and \( \tau' \) refers to the mass creation times with \( m_0 = ct \) and \( m' = ct' = m_0 \gamma \), where \( ct \) is sometimes referred to as a “proper” length and \( t \) as a “proper” time,

which means the density \( g_t = \frac{t'}{t} \) now varies with time \( t_v = \frac{t_c}{b_t} = \frac{t}{\beta} \). Under this interpretation, the “time dilation” is actually \( b_t = \frac{t}{t_v} \) as a Galilean ratio, which allows mass to vary as

\[
m'_t = ct' = (ct)g_t = (m_0 t)g_t,
\]

“Space-Contraction” (\( t_v = t_c \))

The ratio \( \beta = \frac{v}{c} \) can also be preserved by setting \( t_v = t_c \) and allowing the relative variation of \( b_x = \frac{x_v}{x_c} \)

so that \( t_x' = t\gamma_x, \quad \gamma_x = \frac{1}{\sqrt{1 - (b_x)^2}}, \quad b_x = \frac{x_v}{x_c}, \quad 0 < x < x_c \). The “space-contraction” \( b_x = \frac{x_v}{x_c} \)

Is now seen as a contraction \( L = x_v b_x \).

Note that \( b_x b_x = \frac{t_x}{t_v x_c} = \frac{ct}{ct_v} x_v c = \frac{1}{ct} = \frac{v}{c} = \beta \), so that the ratio is preserved in the product.
For $b_z = b_x = 1$, $b_y b_x = l^2$, which emphasizes the concept that $b$ is an “energy” expression in two dimensions when related to space and time.
Space-Time Coordinate Relation to STR

\[ x' = x - x_c \beta_x = x_c (1 - \beta_x) \]

\[ L = x_c \beta_x \text{, “Contraction”} \]

\[ x_c = x_v = \frac{ct_c}{m_0} \]

\[ \Delta x = x_c - x_c \beta_x = x_c (1 - \beta_x) \]

\[ m' = m_0 \gamma \]

\[ (ct', \tau') \]

\[ \tau' = \tau \gamma \]

\[ (ct_c, 0) \]

\[ (0, 0) \]
This diagram (I created this some time ago, as I was learning how to do diagrams) shows a plot of $g$ as a function of $b$, where $g = \frac{t'}{t} = \frac{1}{\sqrt{1 - b^2}}$, $b = \frac{v}{c}$, so that $g$ increases from $g_0 = 1$, $b = 0$ and $b < 1$ asymptotically.

The function is non-linear because the relationship is that of energy, and not of momentum.
**Final State Solution (The Relativistic Unit Circle)**

Dividing both sides of equation (1.1) by the final state \( s' = ct' \) results in the equation (1.3):

\[
y^2 = l^2 = b^2 + \frac{v^2}{c^2} = \frac{1}{\gamma^2} = 1^2 - \beta^2
\]

which can be characterized as the relativistic unit circle, where \( q_a \) rotates ccw from \( 0 \leq \theta \leq \pi \):

\[
l^2 = b^2 + \gamma \frac{v^2}{c^2} = \sin^2 q + \cos^2 q
\]

However, for the Binomial Expansion, the result is:

\[
\hat{j}^2 = \frac{1}{r^2} \hat{r}^2 + 2 \frac{b^2}{g} \hat{r} = \frac{1}{l^2} + 2 \frac{b^2}{g}
\]

In particular, note that \( \frac{1}{g} \hat{i} \cdot \hat{b} = 0 \), but that \( \frac{1}{g} \hat{i} \cdot \hat{b} \cdot \hat{j} = \frac{b}{g} \hat{k} \) and \( \frac{1}{g} \hat{l} \cdot \hat{b} \cdot \hat{b} = 1 \) and

\[
\left| \frac{1}{g} \frac{1}{g} \hat{l} \cdot \hat{b} \cdot \hat{b} \right| = 2 \frac{b}{g} \left( 0 \right) = 4 \frac{1}{2} \frac{b}{g} \left( 0 \right)
\]

when all four quadrants are taken into account.
Note that the radius remains constant as $b$ increases (so $g$ increases and $\frac{1}{g}$ decreases, suggesting that an increase in $g$ represents an increase in density w.r.t. unity ($g = 1, b = 0$), increasing toward infinite density as $\frac{1}{g} \to 0, b \to \infty$. As this happens, note that the final state represented by $l^2 = \frac{c}{\beta^{3/2}} (\alpha t')^2$. “shrinks” as $(\alpha t')^2 \to 0$, so the total “area” of the widget in the final state approaches 0. If $(\alpha t')^2 = 0$, if $c = 0$, there is neither an initial state or a final state; there is “nothing there”. If $t' = 0$, there is only the initial state $\alpha t$.

It is also important to understand that in this approach, there are no restrictions on the value of $c^2$, since the interpretation is only in terms of widget creation...
The Four Quadrants of the Relativistic Unit Circle

The restriction to the upper right quadrant of the relativistic circle can be removed if it is understood that each quadrant is an identical representation of the positive number set \( \{c, v, t, t'\} \), so each quadrant represents one fourth of the total circle. Therefore, the descriptor 1\(_a\) should now be relabeled to replace the original, where 1\(_a\) = \( \frac{1}{4} \{1, 1, 1, 1\} \) (old) now refers to the single relativistic circle characterized by all four quadrants.

Therefore, the single relativistic circle (consisting of positive elements only) is characterized by the single positive unit vector 1\(_a\), where it is represented in matrix notation by \( a = |a| \). Positive real numbers (including integers) \( \{x^+\} \) are then represented individually by the expression \( x = x\{1, 1, 1, 1\} = xi \) where it is understood that \( i \) is the unit vector referencing the system \( a \) and “+” is understood in the present context. These four states can be designated by \( \hat{j}_i: i = 1, 2, 3, 4 \) to designate the separate quadrants for the system \( \{a\} \). 1\(_a\) = (4) \( \sum_{i=1}^{4} \hat{j}_i \), 1\(_i\) = \( \frac{1}{4} \{1, 1, 1, 1\} \), where \( q_a = 4q_j, q_i = \frac{1}{4}q_a \) so that all four quadrants rotate equally, and 1\(_a^2\) = \( \cos^2 q_a + \sin^2 q_a \) = \( \frac{4}{\sum_{i=1}^{4} (1)} \) = \( \cos^2 q_j + \sin^2 q_i \).
All four of the quadrants will be identical (i.e., \( I_1 = I_2 = I_3 = I_4 \)) since they all are generated from the same set of positive real numbers \( \{ c, v, t, t' \} \).

Therefore, the linear part of the relativistic unit circle \( a \) is characterized by

\[
y_a^2 = \frac{\gamma}{\gamma_a b} \cdot 2 \gamma + (b_a)^2 = \gamma_a b \cdot \gamma' \frac{\gamma}{\gamma a} b = (1_a)^2
\]

However, the full characterization of the circle is given by

\[
\gamma^2 - \frac{1}{2} \gamma - \frac{1}{2} \gamma' - \frac{1}{2} \gamma' = \gamma^2 - \frac{1}{2} \gamma - \frac{1}{2} \gamma' = \gamma^2 - \frac{1}{2} \gamma - \frac{1}{2} \gamma'
\]

where the sum over all four quadrants is included in the interaction term \( \frac{\gamma}{\gamma_a b} b \).

In the Relativistic Unit Circle, \( b \) and \( \frac{1}{g} \) are orthogonal, the vector relation in two dimensions is given by

\[
(r^2)^{1/2} = \frac{1}{g} \gamma + b^2 j = \cos^2 q i + \sin^2 q j, \quad r = 1,
\]

where \( q = q_1 = \frac{p}{2} \) is understood to characterize the angle between the orthogonal unit basis vectors \( i = (1)i \) and \( j = (1)j \) in two dimensions.

In one dimension, \( q = q_1 = 0 \), this equation reduces to one dimension:

\[
(1^2 r^2)^{1/2} = \frac{1}{g} \gamma + b^2 j = \cos^2 q i, \quad r = \cos q, \quad r = \frac{c}{c} = \frac{c}{c'}, \quad q = 0
\]

So that for \( r = 1 \), this expression becomes
Then \( i_a = (1_a) i_a \) is the basis vector for a single dimension in the number system \( a \),

where the coefficient of the vector space \( i \) relevant to the RUC is characterized by the single field variable (real number) \( x_a \)

\[
(x_a) i_a = (x_a) (1_a) i_a \quad \text{In the subspace } i_a \text{ in the single number system } x(i_a), \quad x \not\in \{a\}
\]

characterized by the four “proper” field variables in \( a \) \( \{c_a, v_a, t_a, t_a'\} \not\subseteq \{c, v, t, t'\} \) in terms of the relativistic unit circle.

The unit vector \( 1_a \) thus characterizes the state when \( q = 0 \) which is the condition that \( b = 0 \leq v = 0 \), and thus \( ct = ct' \) so that \( t = t' \) independent of \( c \). This is the case when the Initial state is equal to the final state \( s_i = s_f \) in equation (1.2). In particular, again it is emphasized that the condition \( c = 0 \leq ct = ct' = 0 \) means there is no number system at all (i.e., no initial state or final state, so no “change state” (i.e., \( v = 0 \leq vt' = 0 \)).

Then the final state for the single system \( a \) (characterized by \( b = 0 \leq v = 0 \) is given by

\[
1^2 (i_a) = \frac{1}{x_a} \not\in \beta \not\in \gamma \not\in \delta (\sqrt{1^2 - b_a^2}) i_a = \sqrt{1^2 - \frac{v^2}{c_b^2} - \frac{1}{b_a^2}} i_a, \quad b = 0, \quad v = 0, \quad \text{where the final state represents}
\]

the complete set of real numbers \( \{x\} \not\subseteq \{a\} \) (as widgets) from \( x[ct = ct' = 0] \leq x = 0 \) to \( x (ct)^2 = x (ct')^2 = x (1_a)^2 \leq x = x \).
The case when \( q_a = \frac{p}{2} \) represents the “change” basis in the number system \( a \), where

\[
j_a = [\sin q_a] j_a = (1) j_a, q_a = \frac{p}{2}
\]

In this case, \( \frac{1}{g} = \sqrt{1 - b^2} = 0 \), but \( b = \frac{\pi v g}{4 c} \). However, this state is “virtual” since there is no initial state, as outlined above.

When the angle \( q_a \), the unit radius rotates, and while the relative values of \( \frac{1}{g} \) and \( b_a \) may change, the radius \( r = 1 \) is invariant since \( 1^2 \left( 1_a \right) = \cos^2 q_i + \sin^2 q_j \) means that

\[
|r| = |1| = \sqrt{\sin^2 q + \cos^2 q}
\]

is an invariant, where \( 1_a = \cos q_i + \sin q_j \) is an integer only if \( q \geq 0 \) for \( 0 \leq q < \frac{p}{2} \), showing that the system is indeed a relativistic model for a single number system represented by the positive quadrant of the relativistic unit circle.

At \( q_a = \frac{p}{2} \), the number system \( a \) no longer exists (in a sense it has been “destroyed” by the rotation by a ccw rotation from \( q_a = 0 \) - where the initial state equals the final state – to \( q_a = \frac{p}{4} \)).

As an alternative, consider the case when \( q_a \) rotates clockwise from \( \frac{p}{2} \) # \( q_a \) # 0.

At \( q_a = \frac{p}{2} \), \( \frac{1}{g} = 0 \), so the number system \( a \) does not exist, but the “change” vector is at a maximum

\[
\mathbf{b} = v j = 1, v = c.
\]

As \( q_a \) rotates, \( b = \frac{\sin q}{c} \) decreases and \( \frac{1}{g} \) increases until the final state \( q = 0 \) at which point \( \frac{1}{g} = 1 \), \( b = 0 \) and the number system \( a \) consisting of the set of real numbers from 0 to 1 has been created.

Therefore, rotation within the upper quadrant of the unit circle can be characterized as positive widget creation or destruction of the set \( \{a\} \) in the range of 0 to 1 depending on the direction of rotation of \( q_a \).
Interaction in the number system \( \{a\} \)

For the relativistic unit circle, if there is no interaction between the parameters \( \frac{i}{g} \) and \( b \); i.e. between \( \sin \theta \) and \( \cos \theta \) then in vector terminology they are orthogonal \( \frac{1}{g} \) and \( i \) with the complete system characterized at \( q = 0, b = 0, v = 0, \frac{1}{g} = 1 \).

For \( q = \frac{p}{2}, v = c, b = g = 1 \) and the circle plus interaction for the single quadrant is

\[
q_i = 0, b_0 = 0, g_0 = 1
\]

\[
y^2 = \frac{1}{2} \frac{q_i^2}{g_0 b} + b_i^2 = (\cos^2 q_i + \sin^2 q_i) = 1^2
\]

\[
q_2 = \frac{p}{2} \leq v = c, b_1 = \frac{v}{c} = 1
\]

\[
j^2 = \frac{1}{g} \frac{q_i^2}{2 g_0 b} = (\cos^2 q_i + \sin^2 q_i) = 1
\]

If \( t' = t \) the system does not exist, since there is no initial condition; However, within the real number system \( a \) the symmetry of the circle represented by \( \frac{1}{g}, b \) can be distorted in terms of the field variables \( \{c, v, t, t_a\} \) if equation (1.1) is allowed to change in terms of \( \frac{1}{g}, b \) so “mixing” is allowed between \( \sin \theta \) and \( \cos \theta \). This will be the case if two radii are allowed in the system \( a \) which will change the relative values \( \frac{1}{g}, b \) for each radius, but will still remain within the real number system \( a \). This can be accomplished by specifying two angles for each of the radii, so that \( q = q_i + q_2 \) but \( (1_a)^2 = \cos^2 q + \sin^2 q = \cos^2 (q_i + q_2) + \sin^2 (q_i + q_2) \), so the basis of the state is still preserved as the unit integer. Then each pair of radii will have its own values \( \frac{1}{g}, b \), \( \frac{1}{g}, b \), \( \frac{1}{g}, b \), where they

\[
\frac{1}{g}, b, \frac{1}{g}, b
\]
can be combined into the overall description of the relativistic circle for the system $\alpha$ by
\[(1_a)^2 = (1_i)^2 + (1_2)^2\] where \(r_1 = \frac{1}{\sqrt{g_1}} \frac{1}{\sqrt{g_2}} b^2 \) and \(r_2 = \frac{1}{\sqrt{g_1}} \frac{1}{\sqrt{g_2}} b^2 \), but neither \(r_1\) or \(r_2\) is an integer unless \(b_i = b_2 = 0\), in which case \(r_1^2 = \frac{1}{\sqrt{g_1}} \frac{1}{\sqrt{g_2}} b^2 \) and \(r_2^2 = \frac{1}{\sqrt{g_1}} \frac{1}{\sqrt{g_2}} b^2 \) and
\[r_1 = \sqrt{r_1^2} = r_2 = \sqrt{r_2^2} = 1\]

This is accomplished by specifying to sets of field variables within the set \(a = \{c_a, v_a, t_a, t_a'\}\) and \(\{c_a, v_a, t_a, t_a'\}\) This will yield a different set of values where
\[(a')_2 = [a'_1]^2 + [a'_2]^2 = \beta(a')_2 + (a')_2 + \gamma(a')_2 + (a')_2\]

Dividing by \((a')_2\) will create a new basis integer \(1_a\) for the set \(a\) (since all the field variables are still within \(a\), but
\[(a')_2 = \sqrt{[a'_1]^2 + [a'_2]^2} = \sqrt{(a')_2 + (a')_2 + (a')_2 + (a')_2}\]
will not be an integer, since
\[\frac{[a'_1]^2}{[a'_2]^2} = 1_1^2 \text{ and } \frac{[a'_2]^2}{[a'_2]^2} = 1_2^2 \]
are both integers within the set \(a\) where \(g_1 = g_2 = 1\) and
\[b_1 = b_2 = 0 \text{ so } r_1 = r_2 = 1\], so that \((a')_2 = (1_a') = \sqrt{r_1^2 + r_2^2} = \sqrt{1_1^2 + 1_2^2} = \sqrt{2} \), and is therefore not an integer.

Since \(g_1 = 1\) and \(g_2 = 1\) are both unit integers within the same set \(a\), they can both be multiplied by independent real variables within the same set \(x = x^1\) and \(y = y^2\) (where \(x\) and \(y\) can have the same value as above for \(r_1\) and \(r_2\) as basis vectors for the subsets, but are distinguished by the local unit vectors (i.e., within the global set \(a\)) for each variable.

Suppose \((g')^2 = (x, y_2, j_2) = (x_1 + y_2)^2 = \left(x_1 + \frac{1}{\sqrt{g_1}} \frac{1}{\sqrt{g_2}} b\right)^2 + \left(\frac{1}{\sqrt{g_1}} \frac{1}{\sqrt{g_2}} b\right)^2 + 2(\text{rem}(x_1, y_2, 2))\) where
\[x_1 \in \{a\}, y_2 \in \{a\}, 2(\text{rem}(x_1, y_2, 2)) = \text{rem}(x_1, y_2, 2) = \text{rem}(x_1, y_2, 2) \]
and \(x_1y_2 = x_1y_2\) in the Binomial Expansion \(j^2 = (x + y)^2 = x^2 + y^2 + 2xy\) where the subscripts have been dropped in the latter case, since the coefficients \(x\) and \(y\) are already understood wr.t. their respective local basis vectors \((x, y)\) within the set \(a\).

Compare \(j^2 = (x + y)^2 = x^2 + y^2 + 2xy\) with
Fermat’s expression:

\[ y^2 = x^2 + y^2, \]

where \( \text{rem}(x, y, 2) = 2xy = 0 \) which can only be true if \( |x-y| = 0 \), which can only be true if \( q = 0 \) so that \( x \) and \( y \) are parallel (i.e., on the same number line if they have a common origin at the point \( 0i \) so that \( xy(i^i) = yx(i^i) = xy = yx \) on the basis \( (1_a) \).

In the case of Pythagorean triples, where \( y^2 = c^2 = a^2 + b^2 \) for \( \{a, b, c\} \) positive integers, this means that \( 2ab = 0 \) can only occur for \( |a-b| = 0, a*b = b*a = 0 \) or either \( a = 0 \) or \( b = 0 \), all of which are contradictions. The solution is given if imaginary numbers are used, so the interaction (multiplication) term \( ab \) is “created” and “destroyed” by the process \( y^2(1) = [(a+b)(a-b)](1) = (a^2 + b^2)(1) \)

where, so \(-b \in \{a\}\) is not a real number and the set \( \{x, y, -1\} \in \{a\} \) since \( i \in \{a\} \).

That means the expression \( y = a^2 + b^2 \) cannot be in the set \( \{a\} \) since it requires the negative number \(-b = -1(b)\) to generate it from the elements \( a \not\in \{a\} \) and \( b \not\in \{a\} \). Note that this is also true for the general expression \( y = x^2 + y^2, x \not\in \{a\}, y \not\in \{a\} \)

The creation of the plane \( (x, y) \)

The independent elements \( x \not\in \{a\} \) and \( y \not\in \{a\} \) create a plane \( (x, y) \) of real number pairs, where \( . \), where positions in the plane are represented by the products \( 2xy(0) = 2yx(0) \) where the elements \( x \) and \( y \) commute, and can only be eliminated by introducing a complex number for the case \( n = 2 \)

This means the Binomial Expansion for \( n = 2 \): \( j^2 = x^2 + y^2 + 2xy \) is valid within \( \{a\} \) if \( |x-y| = xy(0) \) is also included in \( \{a\} \), so that the product \( xy = yx \not\in \{a\} \); otherwise \( (xy = yx) \not\in \{a\} \) so that \( \{a\} \) does not consist of real numbers where multiplication is assumed in the creation product of the initial condition \( s_0 = \mathbf{c} \).

Again, note that the basis element for the plane \( 1_a \) cannot be an integer if there are two independent radii within the relativistic unit circle. Each of these radii can be characterized as a subset within \( \{a\} \) of real numbers, so each can be designated by its own subscript \( (1_a, 1_a) \) each within the original set \( \{a\} \) where \( 1_a \) is the subset where \( q_a = 0 \) characterizes the initial condition \( \mathbf{c} \), and the second subset
\[ 0 < q_b < \frac{p}{2} \] characterizes the “change” condition \( \forall t' \), where the condition \( q = q_a + q_b = \frac{p}{2} \) means that \( \{a\} \) does not exist, since \( \frac{1}{g} \) does not exist.
Consider the expansion \((1 + \beta)^2 = 1 + 2\beta + \beta^2\) for \(0 \leq q_a < \frac{P}{2}\), so all the numbers \(\{\gamma, \gamma', \tau, \tau'\}_a\) in the system \(a\) are positive real numbers. The area of the triangle \(A_{D(q)}\) in the upper left quadrant is given by \(A_{D(q)} = \frac{1}{2} \frac{q}{g} \frac{b}{g} \frac{y}{b} \). The area of this triangle increases as \(q_a\) rotates ccw from \(0 \leq q_a \leq \frac{P}{4}\), \(\frac{1}{g} = 1, b = 0\) to \(\frac{P}{4}\), with \(\frac{1}{g}\) decreasing from 1 and \(b\) increasing from 0. At \(q = \frac{P}{4}\),

\[
1_a = \cos \frac{\pi}{4}i + \sin \frac{\pi}{4}j = (.707..)i + (.707..)j,
\]

where \(1_a^2 = \cos^2 \frac{\pi}{4}p + \sin^2 \frac{\pi}{4}p\) so that

\[
1 = b = .707..., and A_{D(q)} = \frac{1}{2} \frac{q}{g} \frac{b}{g} \frac{y}{b} = (.707..)^2 = .5.
\]

As \(q_a\) continues to rotate ccw, \(\frac{1}{g}\) continues to decrease and \(b\) increases, until the system \(a\) no longer exists at \(q_a = \frac{P}{2}, \frac{1}{g} = 0, b = 1\).

Notice, however, that \(\frac{1}{g}\) is orthogonal to \(b\) so that \(\frac{1}{g} \cdot b = 0\) always, but

\[
\left| \frac{1}{g} \times b \right| = \frac{b}{g} \sin q > 0, 0 < q \leq \frac{P}{2}
\]

That is, the cross product always exists unless \(q = 0\) if the \(\frac{1}{g} \times b\) and \(b\) are not orthogonal, but \(b\) implies the set \(\{a\}\) does not exist.
Case \( q = \frac{p}{2} \)

In this case, \( \frac{1}{g} = 0 \), but \( b = \frac{v}{c} = \frac{vf'}{ct'} = 1 \), so that \( b \) is unaffected by the individual scaling variables \( t \) and \( t' \). However if \( \frac{1}{g} \) doesn’t exist, then neither does the system \( a \) (the system is complete at \( q = 0 \)). In particular, there is no multiplicative scaling product for the first order terms \( \frac{1}{g}b \) since \( \frac{1}{g}b \left( |j| f \right) = 0 \).

If \( g \) is interpreted as mass and \( b \) is interpreted as charge, then the system is “all charge” and no “mass” – in this case, it is a model of “all change” and no “initial condition”. If \( 1_s \) represents the final state \( v = 0 \) (no “charge”) then \( \frac{1}{g} < 1 \) is the initial state divided by the mass, where it is understood that the initial state is equal to the final state for \( v = 0 \) so that the \( m_0 = 1, v = 0 \) That is the state where \( ct = ct' \) in equation (1.1). If the mass now increases, \( ct' \) and \( vt' \) will both change with \( b' \), but the ratio \( \frac{ct}{ct'} = \frac{t}{t'} = 1, v = 0 \) will remain invariant for \( b' = \frac{v}{c} \). As the mass increases, the initial state decreases, and so does the final state; there is neither a final state or an initial state at \( \frac{1}{g} = 0 \).

Therefore mass change is proportional to both \( b \) and \( g \) relative to \( 0 < b < 1 \), where change is directly proportional to \( b \) and the “rest mass” is inversely proportional to \( \frac{1}{g} \), since \( m_0 = \frac{1}{g} \) for (the final state) invariant.

Note that the “contraction” of \( \frac{1}{g} = \frac{1}{m'} m_s \left( l_{n_s} \right) = \frac{1}{m'} l_{n_s} = 1 \) which is inversely proportional to \( v \) is directly proportional to the “space-time” contraction which increases mass (\( x_c < x_c \)) relative to \( x_c = ct_c \).

Consider equation (1.1) where the first order multiplicative term \( (vt') \) has been included”

\[ (ct')^2 = (vt')^2 + (ct')^2 + vt' \quad (1.14) \]

Dividing by \( (ct')^2 \) as before results in the equation
\[
(ct')^2 = (vt')^2 + (ct)^2 + vt', \quad (1.15)
\]

\[
l^2 = \frac{m^2}{g^2} b^2 + \frac{m^2}{g^2} v^2 (ct')^2 = \frac{m^2}{g^2} b^2 + \frac{m^2}{g^2} v^2 \frac{m^2}{g^2} c^2 + \frac{m^2}{g^2} b^2 + \frac{m^2}{g^2} v^2 \frac{m^2}{g^2} c^2 + \frac{m^2}{g^2} b^2 + \frac{m^2}{g^2} v^2 \frac{m^2}{g^2} c^2 + b
\]

where the r.h.s. is now the equation of the relativistic unit circle + the interaction term \( (1.16) \)

\[
D = \frac{b}{ct'}. \quad \text{For } (v = 0, q = 0), \text{ this term vanishes } D = 0, \text{ but for } q = \frac{p}{2}, v = c \quad D = \frac{1}{c't},
\]

For any angle other than \( q = 0 \) or \( q = \frac{p}{2} \), \( D = \frac{b}{ct'} \) so that \( D t = \frac{bt}{ct'} = \frac{1}{c't} \)

Setting \( c = 1 \) as the reference widget creation rate, \[
\|Dt\| = \left[\frac{1}{g^2} \frac{1}{b} + b \frac{1}{b} \right] = \frac{1}{g^2} \frac{b}{b}, \text{ allowing for}
\]

\[
\text{commutativity so that } \frac{1}{g^2} \frac{1}{b} = b \frac{1}{b} \frac{1}{g} \frac{1}{g} \text{ in the number system } a.
\]

Without this first order of commutativity term, the system \( a \) is incomplete with respect to the real numbers, which requires both first order multiplication and commutativity.

With the addition of the commutative term, the number system \( a \) is now complete for \( 0 \leq q < \frac{p}{2} \)

At \( q = \frac{p}{2} \), \( v = c = 1 \), with the addition of a multiplicative inverse which is always valid since the denominator \( c \) in \( b = \frac{v}{c} \) never vanishes.

**Commutativity of real numbers in the number system \( \{a\} \)**

The operation \[
\frac{1}{g} s b j = \frac{b}{g} j \quad \text{and} \quad b \frac{s}{g} b \frac{1}{g} i = \frac{b}{g} \frac{1}{b} \frac{g}{g} \frac{b}{b} (-k), \text{ where}
\]

\[
\frac{1}{g} s b j + b \frac{s}{g} b \frac{1}{g} i = \frac{b}{g} j + b \frac{1}{g} i = \frac{b}{g} (-k) = \frac{b}{g} (0) \text{ where the null vector characterizes the fact that}
\]

real numbers commute: \( \frac{1}{g^2} \frac{1}{g} b = b \frac{1}{g} \frac{1}{g} \), so the cross product and the null vector represent real number multiplication in the system \( a \).
In particular, note that the multiplicative product \( \frac{b}{g} \) is the coefficient of the null vector, and so is not a member of \((i, j)\), but rather of the three-dimensional vector space \((i, j, 0)\) for the set of real numbers \(\{a\}\) in the range \(0 \leq |a| \leq 1\).

(Note that the process of adding \(k\) to \(-k\) is analogous to considering the positive half plane instead of just the single quadrant, since \(\sin q \neq 0\) always and \(\cos(-q) = \cos q\), so if left and right rotations \(q\) from \(\frac{p}{2}\) to \(p, 0\) are included, then two sets of real numbers on the two vectors \(1_a\) are created, so that \(2(1_a) = 2\{a\}\) and \(1_a = \{a\}\) as before. Different rotations of the two vectors may result in different values of \(\frac{1}{g}\) and \(b\) in the two quadrants at any given state of the two \(q\)'s, but all of the resultants are still included in the set \(\{a\}\) of positive real numbers for the system \(a\).)

In particular, there is only one integer in the number system \(1_a\) in the number system \(a\) for the case \(q = 0, v = 0\) where \(c \mathbf{t}' = c \mathbf{t}, \mathbf{t}' = \mathbf{t}\).

If the interaction is included, the complete real number system \(a\) is the set \(\frac{1}{g}, b, \frac{b}{g}\), which is the unit integer \(\{1_a\}\) when \(q_a = p, v = 0\).

Without the interactive term, the equation of the Unit Circle is

\[
y^2 = \frac{x^2}{g^2} + b^2
\]

(1.17)

And with the interactive term, the equation for the complete number system \(a\) is now

\[
y^2 = \frac{x^2}{g^2} + b^2 + 2\frac{1}{g^2}b
\]

(1.18)

With the interactive term \(2\frac{1}{g^2}b = 0\) only if \(\frac{1}{g^2}b\) are orthogonal (i.e., \(\frac{1}{g^2} b\))

The interactive term can also be made to vanish by imaginatively “adding” and “subtracting” the interaction term in the expression.
\[ y^2 = \left( \frac{1}{a} + i \frac{1}{b} \right)^2 - \left( -i \frac{1}{b} \right)^2 + b^2, \quad i = \sqrt{-1} \]
Comparison of Initial State and Final State Representation of \( \{a\} \neq \{c, v, t, t'\} \)

Note that the ratio of the initial states and the final states remains the same in the unit vector, but that its components change together.

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

In both case, \( q_a \) remains the same; for the Final State \( \tan q_a = \frac{b}{\beta} = \frac{b}{\gamma} \), and for the Initial state, \( \tan q_a = \frac{b}{\gamma} \). Note that for a relativistic circle the areas of the Final state triangle is \( A = \frac{1}{2} \frac{b^2}{\gamma} \) and that of the Initial state triangle is \( A = \frac{1}{2} \frac{b^2}{\gamma} \), but there are four quadrants to the circle, so the total area of the interactions are \( \frac{1}{2} \frac{b^2}{\gamma} = 2\frac{b^2}{\gamma} \) for the Final state and Initial state respectively, so the result is consistent with the Binomial Expansion for the case \( n = 2 \), where:

Final State \( \frac{\frac{ct}{\gamma}}{\frac{ct'}{\gamma}} \) \( = 1^2 \):
\[ y^2 = x^2 + b^2 \]

\[ j^2 = x^2 + b^2 - \frac{1}{2} x^2 - b - b = - + b^2 + 2 = y^2 + 2 \]

and Initial State \( \frac{c t}{\gamma} \) = \( \frac{1}{2} \): \( y^2 = l^2 = \cos^2 \theta + \sin^2 \theta \)

\( j^2 = g^2 = l^2 + \left( bg \right)^2 = y^2 + \left( bg \right)^2, \)

\( \cosh^2 \theta = l^2 + \sinh^2 \theta \)

where each represents the same set of real numbers \( \{ c, v, t, l \} \) \( \notin \{ a \} \)

**Let There Be Light**

“*The Creation of the Universe*”

In the following diagrams, the interactions added by the Binomial Expansions are indicated in blue for the Final State analysis, and red for the Initial State analysis.

Note that the Final State is a relation between trigonometric functions, and that the Initial State is a relation between hyperbolic functions (see *Hyperbolic Functions* below).
Final State Analysis

\[
\frac{ct'}{ct} = t^2
\]

\[
\psi^2 = (\gamma^{-1})^2 + \beta^2
\]

\[
\phi^2 = \left[\left(\gamma^{-1}\right) + \beta\right]^2 = \left(\gamma^{-1}\right)^2 + \beta^2 + 2\left(\frac{\beta}{\gamma}\right) = \psi^2 + 2\left(\frac{\beta}{\gamma}\right)
\]

\[\gamma = \beta = 0, \quad ct' = ct = 0\]

\[\gamma = \frac{1}{\sqrt{1 - \beta^2}}, \quad \beta = \frac{v}{c}\]

\[\cos \theta = \frac{1}{\gamma}, \quad \sin \theta = \beta\]

\[l^2 = \cos^2 \theta + \sin^2 \theta\]

At the point \((0, 0, 0)\) nothing exists, since \(c = 0\). \(m_0 = ct = ct' = \lambda t' = 0\) Note that the ratio \(b = \frac{v}{c}\) assumes that both \(v\) and \(c\) are widget creation rates (so the equation is dimensionally consistent), which have been re-named “light” in the section title. Therefore \(v\) is a light creation rate relative to \(c\).

As \(\gamma\) increases from zero, the center of the circle shifts from a state of “nothing” to “something”. If \(b = 0\) during the process, only the unit vector \(l_o = \frac{ct}{c}i\) is created, so there is no relativistic circle, only a vector in one dimension. However, for \(b > 0\), the diagram grows in three dimensions; the non-interacting relativistic unit circle characterized by \(l^2 = \frac{1}{\gamma^2} + b^2\) remains invariant.
The equal and opposite “spin” interaction is characterized by $2 \binom{b}{h}(0)$ in the Binomial Expansion for $n = 2$.

Initial State Analysis

\[
\begin{align*}
\left( \frac{\sigma}{\gamma} \right)^2 &= 1^2 \\
\gamma &= 1 + \beta \gamma = \varphi \\
\gamma^2 &= \gamma^2 = 1^2 + (\beta \gamma)^2 \\
\varphi^2 &= [1 + (\beta \gamma)]^2 = [1^2 + (\beta \gamma)]^2 + 2 \beta \gamma = \gamma^2 + 2 \beta \gamma
\end{align*}
\]

\[
\begin{align*}
\gamma^2 &= 1^2 + (\beta \gamma)^2 \iff \gamma = \frac{1^2}{\sqrt{1^2 - \beta^2}} \\
A_\theta &= (1)^2, \quad A_\Delta = 4 \left( \frac{1}{2} \right) \beta \gamma = 2 \beta \gamma
\end{align*}
\]

\[
\begin{align*}
\cos \theta &= \frac{1}{\gamma}, \quad \sin \theta = \frac{\beta \gamma}{\gamma} = \beta \\
cosh \theta \equiv \gamma, \quad \sinh \theta \equiv \beta \gamma \\
cosh^2 \theta = 1^2 + \sinh^2 \theta
\end{align*}
\]
The initial state is characterized by

\[
\begin{align*}
\frac{1}{2} \mathbf{c} \cdot \frac{\mathbf{a}}{2} &= r = 1 \\
\mathbf{j}^2 (r \cdot r) = \mathbf{j}^2 (0) &= (1 + bg)^2 (0) = \left( \mathbf{i}^2 (i \cdot i) + (bg)^2 (j \cdot j) \right) + 2gb (k \cdot k) \frac{2}{3} (0) \\
\mathbf{j}^2 &= \frac{1}{r^2} \mathbf{\ell}^2 + (bg)^2 \frac{2}{3} + 2gb = \frac{1}{r^2} \mathbf{\ell}^2 \frac{2}{3} + (bg)^2 \frac{2}{3}
\end{align*}
\]

Note that this characterization is consistent with that the final state \( l' = \frac{ct}{ct} \) :

\[
\begin{align*}
\mathbf{j}'^2 &= \frac{1}{r'^2} \mathbf{\ell}'^2 = (1 + b)^2 = \frac{1}{r^2} \mathbf{\ell}^2 \frac{2}{3} + b^2 + 2gb = 1,
\end{align*}
\]

where \( l' \) “contracts” as the center of the circle moves to the left, with \( g \rightarrow 0 \) as

\[
g \rightarrow 0, \; c \rightarrow 0, \; b \rightarrow 0, \text{ keeping in mind that } \frac{1}{g} = \sqrt{\mathbf{\ell}'^2 - b^2} \text{ so that } l' \rightarrow 0 \text{ along with } b \rightarrow 0.\]
Density and relation to Spin

It is clear that the unit basis element \( 1_a \) represents a minimum of \( \gamma_a \) initial condition in the real number system \( \{c, v, t, t'\}_a \) where \( q_a = 0, b_a = 0 \) and \( g_a = 1_a \). Any rotation of \( g_a \) will increase \((g_a)^2 = (1_a)^2 = \cos^2 \varphi, q = 0 \) to the value \((g_a')^2 = (1_a')^2 = \cos^2 \varphi + \sin^2 \varphi, q > 0, b > 0 \), identically in all four positive quadrants, both inside and outside the unit circle. Then both \( g_a \) and \( b_a \) can be characterized as increases in density from unit density as \( 0 \leq q_a < \frac{p}{2} \) increases towards \( \bullet \) with ccw rotation, and similarly decreases from \( \bullet \) to unit density with clockwise rotation.

Within the unit circle as the final condition, this means that if \( 1_a \) represents the metric in the dimension \( 1_a \) of the real number system \( \{a\} \) where \((c_a)^2 = (1_a)^2 \), then

\[
(c_a')^2 = \frac{1}{g_a} \frac{1}{b} b^2, b > 0
\]

represents a “contraction” of the relative metric (which is not to be interpreted necessarily as a “length” in Galilean “space-time”, but rather as an increase in density of whatever physical parameter is represented by \( g_a \).

Outside the unit circle as the initial condition, \((c_a')^2 = (1_a')^2 = (b g)^2 \)

Spin represented by the interaction between \( g \) and \( b \) with respect to the relativistic unit circle, where

\[
j^2 = (\frac{1}{g} + b)^2 = \frac{1}{g} b^2 + 2 \frac{b}{g}
\]

within the unit circle as the final condition.

Similarly, outside the unit circle as an initial condition a similar rotation will represent a “dilation” of the metric, again representing an increase in density of whatever physical parameter is represented by the product \( b g_a \), which represents a “spin” in the equation

\[
j^2 = (g + b)^2 = g^2 + b^2 + 2 gb \quad \text{outside the unit circle as the initial condition.}
\]

The factor of 2 is because each quadrant contributes a factor of \( \frac{1}{2 g} \) (inside) or \( \frac{1}{2 gb} \) (outside) with the resulting “spins” \( s^2 = 4 \frac{1}{2} \frac{g}{b} \frac{g}{b} = 2 \frac{g}{b} \frac{g}{b} = 2 gb \), respectively.
Interpretation of the Binomial Expansion

The exponent \( n \) in the Binomial Expansion \((g + b)^n = g^n + b^n + \text{rem}(g, b, n)\) represents the equal number of positive widgets represented by \( g \) and \( b \) in the total system, with \( \text{rem}(g, b, n) \) representing the interaction of subsets of the widgets for each power.

For example, in the case \( n = 3 \),

\[
(j^3(r \cdot r))^3 = (g + b)^3 = g^3 + b^3 + 3g^2b + 3gb^2, \quad \text{rem}(g, b, 3) = 3g^2b + 3gb^2
\]

where \( b \) and \( g \) can be identified as angular momentum (respectively) in a system consisting of a center of mass \( g^3 + b^3 \) at \((g^3, b^3)\) where

\[
(j^3(l))^3 = \frac{1}{2} \left( \frac{d}{dr} \right) (g + b)^3 = \frac{1}{2} \left( \frac{d}{dr} \right) (g^3 + b^3) + (3g^2b + 3gb^2)\frac{g}{3}
\]

Note that \((g^2, b)\) and \((g, b^2)\) characterize gradients for \( b \) and \( g \) respectively in the interaction term, and thus correspond to Christoffel symbols in Differential Geometry (and thus GTR), where \( bg \) is identified with \( dgd\) for \( l_\sigma = \frac{ct}{c} \) and \( b \) with \( db \) for \( l_\sigma = \frac{ct}{c} \), respectively.

The case \( n = 4 \) for the Binomial Expansion is also important, as will be addressed in the forthcoming discussion of the Pauli and Dirac matrices.
Relativistic Rotation in the system \{a\}

Positive rotation

The positive rotation $q^+$ here defined as a clockwise rotation characterizes an increase in $b$ in each quadrant from $l_i \rightarrow l_{i+1}$ where it is understood that the indices are cyclic ($l_i \rightarrow l_1$)

- Quadrants 1 and 3
  
  For quadrants $i = 1, 3$ the positive (cw) rotation corresponds to a decrease in $b$ (and an increase in $\frac{1}{g}$) from the initial state at $b = 1, \frac{1}{g} = 0$ and resolving at $b = 0, \frac{1}{g} = 1$ at the next quadrant $(i - 1)$, where it is understood that $g_i \ll 1, \frac{1}{g_i} \ll 0$ so that approximation signs are used at the initial state to indicate that $g_i$ is undefined at $q = 0$ in these quadrants (corresponding to infinite mass, unless $c \tau = 0$ (e.g., $m_b = h_b = 0$ corresponding to the zero state where there is nothing in the Universe, not even light).
Positive rotation in quadrants $j_i$ and $j_3$ then correspond to \( \sin q_i^+ = \frac{1}{g} \), \( \cos q_i^+ = b \), \( i = 1, 3 \) where \( \frac{p}{2} < q_i^+ \neq 0 \) and \( \frac{3p}{2} > q_i^+ \neq 0 \). At \( q_i^+ = \frac{p}{2} \), \( q_i^+ = \frac{3p}{2} \), the basis vectors \( 1_i \) and \( 1_3 \) only exist as change vectors where \( b = l, v = c \), but \( g \) is undefined.

**Quadrants 2 and 4**

For quadrants \( i = 2, 4 \) the positive (cw) rotation corresponds to a decrease in \( \frac{1}{g} \) (and an increase in \( b \)) from the initial state at \( \frac{1}{g} = 1, b_i = 0, q_i = 0, i = 2, 4 \) and resolving at

\[
b_i = 1, \quad \frac{1}{g} = 0, \quad q_i^+ = \frac{p}{2}, \quad i = 2, 4 \quad \text{at the next quadrant \((i-1)\)},\quad \text{where it is understood that}
\]

\[
g_i < \frac{1}{g_i} < 0 \quad \text{so that approximation signs are used at the final state to indicate that \( g_i \) is undefined at \( q_i^+ = \frac{p}{2} \) in these quadrants (corresponding to infinite mass, unless \( c t = 0 \) (e.g., \( m_0 = h_0 = 0 \) corresponding to the zero state where there is nothing in the Universe, not even light)).}

Positive rotation in quadrants \( j_2 \) and \( j_4 \) then correspond to \( \cos q_i^+ = \frac{1}{g} \), \( \sin q_i^+ = b \), \( i = 1, 3 \) where \( \frac{p}{2} < q_i^+ \neq p \) and \( 0 \neq q_i^+ > \frac{3p}{2} \). At \( q_i^+ = q_i^+ = 0 \), the unit basis vectors \( 1_2 \) and \( 1_4 \) are realized.

The rotation, \( q_{(1,3)}^+ \) in quadrants \( j_{(1,3)} \) has the opposite effect on \( b \) and \( \frac{1}{g} \) as the rotation, \( q_{(2,4)}^+ \) in quadrants \( j_{(2,4)} \), so the radius \( 1_a \) is invariant during the rotations, except where it is undefined at

\[
q_a = \frac{p}{2} \quad \text{and} \quad q_a = \frac{3p}{2}, \quad \text{and where} \quad q_a = 0 \quad \text{represents the unit vector} \quad \frac{\hat{1} \, \hat{2}}{2} = \frac{\hat{1} \, \hat{2}}{2} \cos q_a \left( 1_a \right), \quad q_a = 0
\]

and \( q_a = p \) represents the unit vector \( \frac{\hat{1} \, \hat{2}}{2} = \frac{\hat{1} \, \hat{2}}{2} \cos q_a \left( 1_a \right), \quad q_a = p \)

Again it is emphasized that each quadrant yields \( \frac{1}{4} \) the “area” of \( \left( 1_a \right)^2 \) except in the case of \( b = 0 \), in which case the unit vectors for \( q_a = 0, p \) together represent \( \left( 1_a \right)^2 \).
The total "area" $\gamma^2$ of the RUC for $q_i = 0$, $g_i = 1$, $b_i = 0$, $i = 1, 2, 3, 4$ is

$$j_a^2 = (1_a)^2 = \frac{1}{4} \sum_{i=1}^4 (1_i)^2 = \frac{1}{4} \sum_{i=1}^4 (\cos^2 q_i) = \frac{1}{4} \sum_{i=1}^4 (g_i^2) = \frac{1}{4} (4g_i^2),$$

where $(g_a)^2 = (1_a)^2$, $b_a^2 = 0$.

**Negative Rotation**

A ccw rotation can be defined as $q^\gamma$, where $-b = -\frac{v}{c} = \sin(-q^\gamma) = -\sin(q^\gamma)$, which defines the set

$$\{c, v, t, t^\gamma\}_{q^\gamma} \equiv \{c, -v, t, t^\gamma\}_{q^\gamma}.$$  This rotation will not affect $g = \frac{1}{\sqrt{1 - b^2}}$, so that $1_a$ is unaffected, but it allows a distinction between the sets $\{c, v, t, t^\gamma\}_{q^\gamma}$ and $\{c, -v, t, t^\gamma\}_{q^\gamma}$.

(For Physics, this suggests the matrix

$$\begin{vmatrix} q & 0 \\ 0 & -q \end{vmatrix} = \begin{vmatrix} v & 0 \\ 0 & -v \end{vmatrix},$$

where a unit charge $S_3 = \begin{vmatrix} q & 0 \\ 0 & -q \end{vmatrix} = \begin{vmatrix} 1 & 0 \\ 0 & -1 \end{vmatrix}$ characterizes the Pauli $S_3$ matrix).
Consider the equation \( \varphi^2 = (g + b)^2 = g^2 + b^2 + 2gb \), and note that this is inconsistent with that of the relativistic unit circle because of the term \( 2gb \) where \( g \) and \( b \) are both positive (this term is interpreted as “spin” in physics for reasons that will become obvious.). However, if the equation is interpreted as \( \varphi = (g + b)(g + b) \) where \( b = -b \) \( (g = g = g) \) it becomes \( \varphi^2 = (g + b)(g - b) = g^2 + b^2, \) \( b^2 = b^2 = b^2 \) so that the interaction has been removed by the equal and opposite “change” (again, interpreted as “charge” (or photon-equivalent spin) in Physics).

(The necessity of having to use a negative \( b \) to remove the interactive product \( 2gb \) is yet another proof of Fermat’s Theorem, where \( \varphi^n = (g + b)^n = (g^2 + b^2 + 2gb)(g + b)^n \), where \( 2gb \) cannot be eliminated unless the negative element \( b \) is introduced, violating the assumption of positive real numbers in \( \{a\} \).

Since the negative “charge” is irrelevant to the basis vectors for each set, \( x = xi = x_1, \) is positive and \( y = yj = y_1, \) is also positive, so there is no distinction between them that way. Then

\[
\varphi^n = (x^n + y^n) = x^n + y^n + \text{rem}(x, y, n), \text{ rem}(x, y, n) > 0, \text{ so } \varphi^n x^n + y^n, \text{ again proving Fermat’s Theorem.}
\]

**Relativistic Spin (n=2)**

If two independent particles in the sets \( \{x\} \) and \( \{y\} \) have the same value so that \( s = x = y \), then the interactive term is given by \( D = 2xy = 2yx = 2s^2 \) If the interactive term is quantized so that \( 2s^2 = h^2 \), where \( h \) is Planck’s constant, then \( s = \frac{h}{\sqrt{E}} \), which is the “spin” of a quantized particle (electron or photon), and is responsible for the hyperfine splitting observed in atomic spectra, and represents the interaction of a quantized electron (i.e. a photo-equivalent electron) with its surrounding field within a single orbit in the atom.

Note the relevance to the Binomial Expansion for \( n = 2 \)

\[
\varphi^2 = (x + y)^2 = (x^2 + y^2) + 2xy = (x^2 + y^2) + 2yx
\]

In terms of the relativistic unit circle, the equation is

\[
\varphi^2 = \varphi^2(1) + b^2 - \varphi^2(1) - \varphi b \varphi^2 - \varphi^2 b \varphi^2 - \varphi^2 b \varphi^2 - \varphi^2 b \varphi^2 + \frac{h^2}{s} = b = \frac{h}{\sqrt{E}} \text{ so spin is determined by the charge to mass ratio in that interpretation.}
\]
The second real number system \{b\}

Consider the analysis for then number system \(a\) applied to a second real number system \(b\), where \(p \leq q < \frac{p}{2}\) and \(v = 0\), \(q_b = p\), so that the basis vector \(1_b = 1_b \cos q_b\) from the set of field variables \(\{c_b, v_b, t_b, t'_b\}\) \(\neq\) \(\{c, v, t, t'_b\}_b\) which are independent of those of \(a\) in Cartesian space \(\{a\}, \{b\}\)

If the interaction is included, the complete real number system \(b\) is the set \(\frac{-1}{g}, b, \frac{b}{g}\) \(\{b\}\) which is the unit integer \(\{1_b\}\) when \(q_b = p, \ v = 0\), where \(q_b\) now rotates cw from \(q_b = p\) to \(q_b < \frac{p}{2}\)

The integer \(1_b\) at \(v = 0, q_b = p\) is the only integer in the set of real numbers \(\{b\}\)
The Definition of Multiplication

The relativistic unit circle together with the Binomial Expansion can be taken as a definition of multiplication between real numbers.

Within the single real number system \( \{x\} \equiv \{c, v, t, t'\} \), the two bases characterizing the initial and final conditions are given by

\[
(1)^2 = \frac{1}{g} + b + \frac{1}{g} + \left(\frac{1}{g}\right)^2 + 2 \frac{1}{g} \left(\frac{1}{g}\right)^2 , \quad (1)^2 = \frac{ct}{g} \quad (1.1)
\]

And

\[
(1)^2 = (g_x)^2 - (b_x)^2 (g_x)^2 = (g_x)^2 (1_x)^2 - (b_x)^2 \left(\frac{1}{g}\right)^2 , \quad (1_x)^2 = \frac{ct}{g} \quad (1.2)
\]

Neither of these equations can be valid for \( q_x = \frac{p}{2} \) and both are equal to \( (1_x)^2 \) otherwise, so multiplication is defined by \( \frac{ct}{g} b \) and \( 2 (b_x)^2 (g_x)^2 \) respectively, where the factor of two arises from the fact that all four quadrants of the relativistic unit circle have to be taken into account.

Similarly, for powers of expansion, we have

\[
(1)^n = \frac{1}{g} + b + \frac{1}{g} + \left(\frac{1}{g}\right)^n + \left(\frac{1}{g}\right)^n b + \left(\frac{1}{g}\right)^n \text{rem}(\frac{1}{g}, b, n) = \frac{1}{g} + b + \left(\frac{1}{g}\right)^n \text{rem}(\frac{1}{g}, b, n) \quad \text{where}
\]

\[
(1)^n = \frac{1}{g} + \left(\frac{1}{g}\right)^n + \left(\frac{1}{g}\right)^n - \frac{1}{g} \text{rem}(\frac{1}{g}, b, n), n - 2 \quad \frac{1}{2} \text{ and similarly for}
\]

\[
(1_x)^n = (g_x)^n + (b_x)^n + \text{rem}(g_x)^n, (b_x)^n, n - 2 \frac{2}{3}, \text{ where } \text{rem}(g_x)^n, (b_x)^n, n - 2 \frac{2}{3} \text{ defines multiplication for both cases.}
\]
Since these equations hold for $q_x$ for all real numbers, then the equations $(1_x)^n = \sum_{g \neq b} \frac{1}{b^n} + (b_x)^n$ and $(1_x)^n = (g_x)^n + (b_x)^n$ lack the operation of multiplication even in the same number system. Therefore, Fermat’s expression is not true for any pair of real numbers in a system where multiplication is defined, since the products are identically equal to zero.
That is, $\overline{x^n} = (x + y)^n = x^n + y^n + \text{rem}(x, y, n)$ characterizes multiplication between two systems $(\{x\} \not\equiv \{c, v, t, t^1\}, \{y\} \not\equiv \{c, v, t, t^1\})$ and $\overline{y_n} = \overline{x} + \overline{y}$ does not (there is no multiplication between $x$ and $y$). Since this result is true for all $\left( n_x = n_x 1_x, n_y = n_y 1_y \right)$, Fermat’s Theorem is proven (the integers are a subset of the real numbers).
The plane of integers

Since the number systems $a$ and $b$ are independent, the two integers $1_a$ and $1_b$ form an orthogonal system $(1_a, 1_b)$, where the vector basis can be represented by $(i, j)$. Since scalar multiplication is now included, each of these systems can be multiplied by and real number in their respective systems, where the variables are represented by $(x, y) \# (x_a 1_a, y_b 1_b)$, and in particular, if the numbers are integers, by $(a, b) \# (a_1 a, b_1 b)$ where now $a$ and $b$ represent integer variables over their respective sets...

Since the sets $\{a\}$ and $\{b\}$ are disjunct, the set $(a, b)$ is called binomial.

If there is no interaction between the two sets of integers, then

$$y^2 = a^2 + b^2,$$

meaning there are no multiplicative terms of the form $ab = ba$, which means that $a \cdot b = 0$. That is, $a$ and $b$ are restricted to their respective number lines as coefficients of the unit vectors. Note that this expression can only be generated $y^2 = (a + b)(a - b) = a^2 + b^2$, which requires the integer $-b \in \{b\}$ and $-a \in \{a\}$.

(Note: To eliminate relativistic energy interaction, one must use complex numbers so that

$$y^4 = i a^2 + (ib) \frac{2}{3} a^2 - (ib) \frac{2}{3} = a^4 + b^4,$$

which is implemented in both the Pauli and Dirac Matrices in various ways.)

However, if there is interaction, then the Binomial Expansion for the case $n = 2$ results in the expression $j^2 = (a + b)^2 = a^2 + b^2 + 2ab = a^2 + b^2 + \text{rem}(a, b, 2)$, where the system of independent integers is now complete.

For the incomplete system (with the elimination of $ab = ba$) $y^2 = a^2 + b^2$, if $y$ is an integer, and the system is the set of $\{a, b, c\}$ of Pythagorean Triples, where $y = c$.

However, if the system is complete, it includes multiplicative products, so the Binomial Expansion holds. However,

$$j = \sqrt{(a + b)^2} = \sqrt{a^2 + b^2 + 2ab} =$$

$$\sqrt{a^2 + b^2 + \text{rem}(a, b, 2)} =$$

$$\sqrt{a^2 i + b^2 j + \sqrt{2} \sqrt{ab}(0)} =$$

$$a + b + \sqrt{\sqrt{2} \sqrt{ab}}$$
cannot be an integer even if $\sqrt{ab}$ is an integer.
For \( n > 2 \), the Binomial Expansion is given by

\[ (a + b)^n = A^n + b^n + \text{rem}(a, b, n) \]

where \( \text{rem}(a, b, n) \) consists of all the terms in the expansion that are not \( a^n \) or \( b^n \).

Formally, the Binomial Expansion (Wikipedia) is given by

\[
^n \binom{n}{k} a^k b^{n-k}, \quad \binom{n}{k} = \frac{n!}{k!(n-k)!}
\]

Note that with the exception of \( a^n (n = k) \) and \( b^0 (k = 0) \), all the terms in the expansion are of the form \( a^p b^{n-q} \), where the terms \( a^p b^{n-q} = b^{n-q} a^p \) commute, but the terms \( a^p b^{n-q} \neq b^{n-q} a^p \) do not for the case \( n > 2 \) (as was the case in first order where \( a^1 b^1 = b^1 a^1 \) in the case \( n = 2 \)).

That is, the terms in \( \text{rem}(a, b, n) \) for \( n > 2 \) can never be eliminated, since \( a^p \) is never orthogonal to \( b^{n-q} \), even though the products form coefficients of the null vector, so that

\[ (a + b)^n \neq A^n + b^n j + \text{rem}(a, b, n)(0), \]

where each term in \( \text{rem}(a, b, n)(0) \) is located at the position \((a^n, b^{n-q})\) on the integer plane.

**Pythagorean Triples**

Although it might appear that a right triangle formed by a Pythagorean triple is two dimensional in nature, the process actually results from counting relativistic unit circles; in a \( \{3, 4, 5\} \) triple, the equation \( 25 = 16 + 9 \) in vector form is actually \( 25 = \sum_{i=1}^{25} 1_i \) where each \( 1_i \) represents a circle in its initial state where \( a_i = 0, b_i = 0, g_i = 1 \), where each set is formed from its own set \( \{c, v, t, t^t\}_i \), so the separate real systems for each integer are independent.

Then \( 25(1_a) = (16 + 9)(1_a) \) actually represents \( 25\{c, v, t, t^t\}_a \) individual real number systems with the above conditions. The coefficients seem to be independent because the real number sets are independent. Thus integers do not interact with each other, so that \( 3(1_a) \neq 4(1_b) \).

The actual values of Pythagorean triples then depend on the number base (as in “n to the base 10”) of the individual system in which they are represented; systems in different number bases will have different values and symmetry groupings.
The fact that \((3, 4)\) appear to be independent in a \(\{3, 4, 5\}\) right triangle is because the unit bases for each relativistic circle are independent; the symmetry arises from partitioning the unit elements (established from the base 10).

A “Pythagorean function” would then be relationship between number systems of different bases, which would establish the value of each symmetry in each base (and even relative to each other).

Pythagorean triples satisfy the Binomial Theorem for \(n = 2\):

\[
j^2 = (a + b)^2 = (a^2 + b^2) + 2ab
\]

\(a = 3, \ b = 4\)

\[
j^2 = 3(3)^2 + (4)^2 + 2[3 \cdot 4] = (3 + 4)^2
\]

\[
j^2 = [9 + 16] + 24 = 49
\]

Then the triple \((a, b, c)\) is a Pythagorean triple if \(j = \sqrt{j^2}\) is an integer.

Pythagorean triples can be generated by the equation

\[
c^2 = (a + ib)(a - ib) = a^2 + b^2
\]

**Definition of Group (Group Multiplication)**

In abstract algebra, this means that each element \(a(1, \{c, v, t, t\})_a\) of a group is within an individual set of real numbers \(\{c, v, t, t\}\) where \(q_a = 0, \ b_a = 0, \ g_a = 1_a = 1\) (i.e., the symbol “\(a\)” as a representative of the group is the unit element \(1_a(\{c, v, t, t\})_a\)).

Consider multiplication between two group elements \(ab = ba\). Then define a group element \(c\) such that \(c = ab = ba\), where \((a, b, c)\) generates \(G\).

Define a second group element \(d = a + b\). Then \((a, b, c, d)\) generates \(G\).

Then \(d^2 = (a + b)^2 = (a + b)(a + b) = (a^2 + b^2) + 2ab = (a^2 + b^2) + 2c = (aa + bb) + 2c\), so that \(d^2 = (a + b)(a + b)\) generates \(G\).

Then if \(c = ab = ba\) defines group multiplication for all group elements \(\{a, b, c, d\}\)

\[
c = ab = \frac{1}{2}d^2 - \left(a^2 + b^2\right)\frac{1}{3}
\]
Since $c$ consists of only products $ab$, but not sums, then both $d = a + b = 0$ and $d^2 = (a + b)^2 = 0$

Then $c = ab = ba$ cannot represent group multiplication for all elements $\{a, b, c, d, d^2\} \subseteq G$, so the operations $+$ and $\cdot$ are incomplete, and must be replaced by $\oplus$ and $\otimes$ (direct sums and products), and so characterize vector components in two dimensions.
Fermat’s Theorem

Fermat’s expression is

\[ y^n = c^n = a^n + b^n \]

Fermat’s Theorem says the expression cannot be true for positive integers \( \{a, b, c, n\} \) for \( n > 2 \) without multiplicative terms such as \( ab = ba \) or \( a^n b^{n-q} = b^{n-q} a^n \), and is therefore incomplete for the independent sets of integers \( (a, b) \) which require the basis vectors \( (1_a, 1_b) \).
Proof Fermat’s Theorem

A real positive variable \( x_a \) \( \in [c, v, t', t] \) can be assigned to \( \{a\} \) where \( x_a = x_a (c, v, t, t') \) ranges over all possible values that satisfy equation (1.1); i.e.,

\[
\mathbf{J}_a (x) = (x^2) (1^2) = x \left( \cos^2 q^+ + \sin^2 q^+ \right) = x \left( \frac{1}{2} \right) + (b)^2 \quad \text{valid for all } (c, v, t, t') \in a
\]

The same analysis can be performed to characterize an independent second set \( y_b \) \( \in [c, v, t', t] \), so that

\[
\mathbf{J}_b (y) = (y^2) (1^2) = y \left( \cos^2 q^+ + \sin^2 q^+ \right) = y \left( \frac{1}{2} \right) + (b)^2 \quad \text{valid for all } (c, v, t, t') \in b
\]

where \( y \in \{b\} \) and \( x \in \{a\} \), and the same for a third independent variable \( r \) \( \in [c, v, t', t] \), satisfying equation (1.1)

Then renaming \( x = j_a (x) \) and \( y = j_b (y) \), the space \( z = f (x, y, r) \) is a positive real single-valued function consisting of all real positive combinations of \( x, y \) and \( r \).

In particular, note that \( x' \ni \{a\} \) and \( y' \ni \{b\} \).

Since the variables are independent, the direct sum and outer product can be used to define ordinary addition and multiplication between all the elements of each independent set:

\[
(x + y)' \ni (x \otimes y)' \quad \text{and} \quad xy = yx = \left| \mathcal{F} \right| y
\]

are all positive numbers

Let \( z' = (x + y)' = x' + y' + \text{rem}(x, y, r) \) where \( \text{rem}(x, y, r) > 0 \) consists of all elements of the

Binomial Expansion \( n \ni 2 \) where \( \text{rem}(x, y, n) \ni x^n \) and \( \text{rem}(x, y, n) \ni y^n \).

Then \( z' \ni x' + y' \), and in particular when \( \{x, y, r\} \) are integers. Thus Fermat’s Theorem is proven, since the relativistic unit circle is complete for all positive real numbers in \( \{x\}, \{y\} \) and \( \{r\} \).

The Binomial Theorem (Wikipedia), where the general expression is given by
\[(x + y)^n = \sum_{k=0}^{n} \binom{n}{k} x^{n-k} y^k, \text{ where the coefficient of } x^{n-k} y^k \text{ is given by the formula } \binom{n}{k} = \frac{n!}{k!(n-k)!} \]

Since integers are a subset of the real numbers, this expression can be restricted to integers in the following form:

\[
\phi^n = (a + b)^n = (a + b)^{n-2} \left[ a^n i + b^n j + \text{rem}(a, b, n) \right] (0), \text{ where } \text{rem}(a, b, n) \text{ includes everything in } \phi^n \text{ that is not } a^n \text{ or } b^n, \text{ and } (0) = [\phi^j]
\]

The Binomial Expansion is complete, but \( \text{rem}(a, b, n) \) vanishes only if \( a = 0 \) or \( b = 0 \), in which case \( \phi^n = b^n \) or \( \phi^n = a^n \) respectively. This an example of Quantum Triviality for the case of two distinct Planck's constants (two different photon energies) where the one remaining element is the Higgs Boson.

Note that \( \phi^n \) is an integer even for \( n = 2 \), but that for \( n = 1 \) it cannot because of the \( \sqrt{c} \)

unless \( a \) and \( b \) are on the same number line in one dimension, in which case the expressions \( c = a + b = b + a \) and \( c = ab = ba \) are tautologies, since the l.h.s. and the r.h.s. refer to the same single number in each equation.

Fermat's expression represents the metric of an arithmetic, which only includes addition and powers (of independent elements), and so is an example of an arithmetic system that is consistent, but not complete. If the system does include integer multiplication, then the system is complete, but is not consistent with Gödel numbering, which does not include the \( \sqrt{c} \) in its syntax (i.e., does not include scalar multiplication, but only partitioning counts into additive groups in one dimension).

In particular, Fermat's Theorem is a relationship between groups, where \( a = a l_a \) and \( b = 1_b \)

where \( q_a = 0, b_i = 0, g_i = 1, l = 1, i = a, b \), so that Fermat's Expression \( c^n = a^n + b^n \) does not include multiplication of integers represented by \( a \{ c, v, t, t \} \) and \( b \{ c, v, t, t \} \), so cannot be complete in the set of all integers \( \{ c, v, t, t \} \) which include all possible sets of positive real numbers.

The Binomial Expansion is complete for the groups \( a \) and \( b \), and since \( \text{rem}(a, b, n) > 0 \) for all groups represented by the variables \( a \) and \( b \), Fermat's Theorem is proved.
Fermat’s Theorem and Presburger Arithmetic

Note that the multiplication for $n > 2$ cannot be removed by using first-order complex numbers on the interaction products for $a$ and $b$ as it can for $n = 2$, where both elements in the product are first order.

\[
(y^n)^2 = (a^n + b^n) + i(\text{rem}(a, b, n)) = (a^n + b^n) + (\text{rem}(a, b, n))^2
\]

Contrasted with

\[
y^2 = (a + ib)(a - ib) = (a^2 + iab - iab + b^2) = a^2 + b^2 \text{ for the case } n = 2
\]

Therefore, the Fermat expression represents a Presburger arithmetic (Wikipedia) consisting of addition only, in which multiplication is eliminated by complex numbers, so the Presburger arithmetic cannot be complete in terms of real numbers (including integers), and so the expression cannot be true for any set of real numbers satisfying the Binomial Expansion.

This also proves Gödel’s Theorem, since his syntactical elements are represented only by prime numbers as positive integers, so that if the Binomial Expansion is complete and consistent, then Fermat’s Expression cannot be complete for any two independent elements $(a, b)$ or $(x, y)$ characterized by

\[
(g, b) \text{ where } j^2 = (g + b)^2 = g^2 + b^2 + 2gb
\]

and

\[
(j^n = (g + b)^n = g^n + b^n + \text{rem}(g, b, n), \ 1_a = \frac{ct}{ct}
\]

where

\[
\{g, b\}_{x, y} \notin \{c, v, t, t\}_{x, y} \notin \{x, y\}
\]

when scalar multiplication (interaction) is included
Positive Real Numbers over the same set

Let \( x = g \), \( y = b \), \( \{ x \} \not\in \{ c, v, t, t' \} \), \( \{ y \} \not\in \{ c, v, t, t' \} \), and \( \{ x \} = \{ y \} \)

Let \( x = ct \) and \( y = ct' \), expressing the initial and final states, respectively.

Then for the final state

\[
\frac{ct}{x} = 1, \quad 1^2 = \frac{1}{x^2} + y^2, \quad \text{and for the final state}, \quad \frac{ct'}{y} = 1, \quad x^2 = 1^2 + xy
\]

so that solving for \( y \)

\[
x^2 = 1^2 + xy
\]

\[
\cos^2 q = 1^2 + \sin q \cos q
\]

\[
\frac{x^2 - 1^2}{x} = y
\]

So that \( \cos^2 q = 1^2 \) only if \( q = 0 \), \( b = 0 \), and \( \sin^2 q < 1^2 \), \( (b^2 < 1) \) always in the relativistic unit circle.

Definition of Multiplication

Then \( xy = 1^2 - x^2 \Rightarrow 2xy = 2(1^2 - x^2) \) can be taken as the definition of multiplication between positive real numbers \( x \) and \( y \) in the same set \((c, v, t, t')\), where \( j^2 = (x + y)^2 = x^2 + y^2 + 2xy \) includes all four quadrants of the relativistic unit circle, and is valid for all positive values of \( x = |x| \) and \( y = |y| \) within the single real number system \((c, v, t, t')_x = (c, v, t, t')_y \) where the four parameters \((c, v, t, t')\) can vary independently for the variables \( x \) and \( y \) over the set.

This result then results in the Binomial Expansion (Wikipedia) by expanding to powers of \( n \):

\[
\binom{n}{k} x^k y^{n-k} = \frac{n!}{k!(n-k)!}
\]

Where \( j^n = (x + y)^n = x^n + y^n + rem(x, y, n) \), and \( rem(x, y, n) = j^n - (x^n + y^n) \), \( rem(x, y, n) > 0 \) which proves Fermat’s Theorem for his expression \( x^n + y^n \quad p \quad (x + y)^n \) for all positive real numbers, not just integers. That is, \( (x^n)^2 = (x^n + y^n)^2 = (x^n + iy^n)(x^n - iy^n) \) so the set of numbers that allows this expression cannot be composed of positive real number alone; it must include complex numbers, which
allow for elimination of the interactive elements....
Relativistic Addition of Velocities (and relation to Newtonian Energy)

The relativistic velocity multiplication formula is usually written as:

\[ V_r = \frac{u + v}{1 + \frac{uv}{c^2}} \]

Since the two positive quadrants of the relativistic unit circle characterize two independent sets of real numbers \( \{x\} \) and \( \{y\} \) where ordinary multiplication between is the relation between them in the final state where \( xy = [x_1, y_1] = xy(0) \), in terms of the RUC, this is equivalent to multiplying change states within each quadrant:

\[ V_r = \frac{u + v}{1 + \frac{uv}{c^2}} \frac{b_x + b_y}{1 + \frac{b_x b_y}{c^2}} \]

where for \( v_x = 0 \) or \( v_y = 0 \), \( V_r = b_y \) or \( V_r = b_x \), respectively. It has already been shown that in the Galilean coordinate system \( (b_x b_y)_x = b_x \) (where in this context \( (x, t) \) represent Galilean coordinates) in the single number system. Then

\[ \lim_{c \to 1, b_x, b_y \to 0} \sqrt{\frac{c^2}{c^2 + b_x b_y}} = \frac{c^2(b_x + b_y)}{c^2 + b_x b_y} = \left( \frac{v_x + v_y}{c^2 + b_x b_y} \right)^{\frac{1}{2}} = v + v \]

(1.4),

\[ \lim_{c \to 1, b_x, b_y \to 0} \frac{1}{\sqrt{c^2 + b_x b_y}} = \frac{1}{\sqrt{c^2 + b_x b_y}} \]

corresponding to ordinary addition of velocities between the complete sets \( \{a\} \) and \( \{b\} \), where \( v_x 1_a + v_y 1_b = v_x + v_y \) in the sets \( \{a\} \approx \{b\} \)

\[ j^2 = (v_x + v_y)^2 = (v_x)^2 + (v_y)^2 + 2v_x v_y \]

If there is no "interaction" between \( v_x \) and \( v_y \) (so they are independent \( v_x \perp v_y \)), then the term \( 2v_x v_y \) vanishes, so that

\[ y^2 = (v_x)^2 + (v_y)^2 \].

Then for a single invariant (Newtonian) mass \( m \), \( m y^2 = m(v_x)^2 + m(v_y)^2 \) so the kinetic energies add, and \( y^2(m_1, m_2) = m_1(v_x)^2 + m_2(v_y)^2 \)

Then the Newtonian velocity relating to energy is given by \( v_x^2 = 2(v_x 1_x)^2 \) and the total Newtonian energy of two particles, each of mass \( m \), is given by \( E_n = m_n (v_n)^2 \)
Note, however, that a relativistic change in velocity is tantamount to an acceleration, and the Newtonian analysis does not address the corresponding change in \( m_a = \frac{1}{g_a}, m_b = \frac{1}{g_b} \), which then must be considered infinitesimal in the limit, so the effect must be characterized for both relativistic velocities very close to \( c \), so that \( b_a \approx 1, b_a < 1 \) and therefore in the limit as \( b \to 1 \).

Therefore, practically no mass is involved, and the effect is due mostly to charge, which is why Einstein introduced differentials to model gravity... within the single real number system \( a \).

Then \( f'(\frac{1}{g_a \cdot g_b}) = \lim_{b_a, b_b \to 0} \frac{f\left(\frac{1}{g_a \cdot g_b} - b_a b_b\right) - f\left(\frac{1}{g_a \cdot g_b}\right)}{b_a b_b} \) where \( f\left(\frac{1}{g_a \cdot g_b}\right) b_a b_b \) at the limit, and is the tangent to the geodesic at \( \frac{1}{g_a \cdot g_b}, \frac{f\left(\frac{1}{g_a \cdot g_b}\right)}{3} \) in the GTR relativistic theory of mass, and light (as charge) has infinitesimal but real mass.

That is, if \( \frac{b_a}{g_a}, \frac{b_b}{g_b} \) is interpreted as the charge to mass ratio for each photo-equivalent systems \( \{a\} \) and \( \{b\} \), then \( f'(g_{ab}) = f'(m_{ab}) = \frac{df\left(\frac{1}{g_{ab}}\right)}{d\left(b_a b_b\right)} = \frac{dm_{(a,b)}}{d\left(a_{(a,b)}\right)} \). Note the analogy with \( f'(g_{ab}) = f'(m_{ab}) = \lim_{h \to 0} \frac{f(m + h) - f(h)}{h} = \frac{df(m)}{d(h)} \) where \( h \) is Planck's constant characterizing the action ("energy") of a photo-equivalent electron...

The addition of relativistic velocities corresponds to ordinary multiplication, since
\[
V = \frac{b_x + b_y}{\sqrt{1 + \frac{x^2}{c^2} + \frac{y^2}{c^2}}} = 2(\sqrt{1 + \frac{x^2}{c^2} + \frac{y^2}{c^2}}) = 2(\sqrt{1 + \frac{x^2}{c^2}} + \sqrt{1 + \frac{y^2}{c^2}})
\]
Initial State Solution (The Continuum)

For the initial state solution to the equation \((1.1)\), both sides of the equation are divided by the initial state \(s_0 = (ct)^2\), which results in equation (1.5); \(g^2 = l^2 + (bg)^2\).

Since \(b = \frac{v}{c} < 1\), the triangle extends to the right with increasing \(b\), but \(g \neq \beta g\).

However, the equation \(g^2 = l^2 + bg\) is still inconsistent with the Binomial Expansion, characterized by

\[ j^2 = (1 + bg)^2 = l^2 + (bg)^2 + 2bg \]

As before, the “interaction” term \(2bg\) can be only removed by the complex conjugate:

\[ y^2 = \|l^1 + i(bg)\|^2. \]

\[ y^2 = \|l^1 - i(bg)\|^2 = l^2 + (bg)^2 = g^2 \]
For the general Binomial Expansion, the expression becomes:

\[ j^n = (1 + bg)^n = 1^n + (bg)^n + \text{rem}(1, bg, n), \]

where again \( \text{rem}(1, bg, n) > 0 \) so that

\[ j^n p_1^n + (bg)^n. \]

Note that this will appear as power expansion in \( b \) with Binomial Coefficients (but only if one ignores the powers of unity, which indicate the number of unit interactions for each term, and thus is misleading in that interpretation).
Euler’s Formula and the Binomial Expansion

Euler’s equation is $e^{i\theta} = \cos \theta + i \sin \theta$

The expression $Y^2 = (\cos \theta + i \sin \theta)(\cos \theta - i \sin \theta) = \cos^2 \theta + \sin^2 \theta = 1^2$ eliminates the interaction term by complex conjugation, compared to the Binomial Expansion for $n = 2$:

$\mathbf{j}^2 = (\cos \theta + i \sin \theta)^2 = \cos^2 \theta + \sin^2 \theta + 2\cos \theta \sin \theta$

Relativistic Consequences

Case $\frac{\mathbf{c}^2}{\sqrt{\mathbf{c}^2 + \mathbf{b}^2}} = 1^2$ (invariant final state)

This equation eliminates interaction between $\cos \theta$ and $\sin \theta$ ($\frac{1}{\gamma}$ and $\beta$ respectively), where

$Y^2 = (\cos \theta + i \sin \theta)(\cos \theta - i \sin \theta) = \cos^2 \theta + \sin^2 \theta = 1^2$

The Binomial Expansion for $n = 2$ of this equation is given by:

$\mathbf{j}^2 = (\cos \theta + \sin \theta)(\cos \theta + \sin \theta) = \cos^2 \theta + \sin^2 \theta + 2\sin \theta \cos \theta = \frac{1}{\gamma^2} + \beta^2 + 2\frac{\beta \gamma}{\gamma^2} \frac{\beta}{\gamma}$

Note that the interaction “area” in each quadrant of the relativistic unit circle is $A = \frac{1}{4} \beta \gamma$, which accounts for the factor of 2, where

$\mathbf{j}^2 = \frac{1}{\gamma^2} + \beta^2 + 4\frac{\beta \gamma}{\gamma^2} \frac{\beta}{\gamma} = \frac{1}{\gamma^2} + \beta^2 + 2\frac{\beta \gamma}{\gamma^2} \frac{\beta}{\gamma}$

Higher orders of the Binomial Expansion are given by

$\mathbf{j}^2 = (\cos \theta + \sin \theta)^n = \cos^n \theta + \sin^n \theta + \text{rem}(\cos \theta, \sin \theta, n)$

Case $\frac{\mathbf{c}^2}{\sqrt{\mathbf{c}^2 + \mathbf{b}^2}} = 1^2$

From the Binomial Expansion $(n = 2)$ of $\mathbf{j}^2 = (1 + \beta \gamma)^2 = 1^2 + (\beta \gamma)^2 + 2\beta \gamma$
The interaction term is eliminated in the expression:

\[ y^2 = (1 + igb)(1 - igb) = 1^2 + (gb)^2, \]  
which corresponds to the relativistic expression

\[ g^2 = 1^2 + (gb)^2, \]  
where \( g = \frac{1}{\sqrt{1 - b^2}} \).

The “time dilation” equation arises because of the elimination of the interaction products and for the case \( n = 2 \) in the Binomial Expansion, where \( \frac{1}{b}, \frac{b}{b} \) are orthogonal (i.e., independent

\[ \frac{1}{g} \quad \text{for} \quad \frac{c}{b} = 1^2 \quad \text{and} \quad (1, bg) \quad \text{are orthogonal} \]

\( \frac{c}{b} = 1^2 \).

This makes the linear form Special Theory of Relativity consistent with Maxwell’s equations for both electromagnetism and relativistic mass individually, but not for both (which are related by the Lorentz force and the “vector potential” \( A \)).

Note that the conditions on the vector potential for the Electromagnetic Potential are that the covariant and contravariant derivatives multiply the null vector (i.e., are “equal” and “opposite”). These derivatives correspond to the “spin” interaction terms in the Binomial Expansion (for \( n = 2 \)) for both the initial and final invariant conditions. For higher orders of interaction, the conditions on the vector potential cannot hold, since the derivatives do not commute.

However, Maxwell’s equations achieve linearity due to the use of dot and cross products in the Stokes’ and Green’s formulation with respect to areas and volumes in terms of charge and current only, and QFT achieves linearity through the elimination of the interaction terms \( m_v m_0 \) through the use of the expression

\[ y^2 = (m_0 + im_v)(m_0 - im_v) = (m_0)^2 + (m_v)^2 \]  
which is an expression of the concept that the “perturbation” does not affect the rest mass (the initial condition).

The Binomial Expansion (for \( n = 2 \)) includes this interaction, and is expressed as

\[ j^2 = (m_0 + m_v)^2 = (m_0)^2 + (m_v)^2 + 2m_0 m_v \]  
where \( m_v \) “scales” \( m_0 \) and is physically to be included in the final result as a non-linearity.

For higher orders of interaction, the expression becomes

\[ j^a = (m_0 + m_v)^a = (m_0)^a + (m_v)^a + rem(m_0, m_v, n) \]
The Hyperbolic Functions (Initial State Invariant)

Again, it is emphasized that in this context, all four quadrants of the relativistic diagram are positive, so the interaction term is actually $2\gamma\beta$ when the relativistic unit circle is taken as the initial state.

$$\frac{\frac{dx}{dt}}{\frac{dt}{\sqrt{c^2 - x^2}}} = 1^2,$$ so that $g^2 \# 1^2$, so that

$$g^2 = 1^2 + (\gamma \beta)^2, \quad g^2 = \frac{1^2}{1^2 - b^2}, \quad g = \frac{1}{\sqrt{1^2 - b^2}} = \frac{1}{\sqrt{1^2 + (i\beta)^2}}$$

(Note that $\frac{1}{g^2} = 1^2 - b^2$ corresponding to the relativistic unit circle) where

$$l^2 = y^2 + b^2 = (1^2 - b^2) + b^2 = 1^2 + (i\beta)^2 + b^2$$

The Hyperbolic Function (Wikipedia) characterization of the Special Theory of relativity characterized in terms of $x = r = (\gamma \beta)$ where $r$ is the radius of the change equivalent circle expanded from $g^2 = 1^2$ to

$$g^2 = 1^2 + (\gamma \beta)^2.$$

$$\cosh r = \frac{e^r + e^{-r}}{2} = \frac{e^{2r} + 1^2}{2e^r} = \frac{1 + e^{-2r}}{2e^r}$$

$$\sinh r = \frac{e^r - e^{-r}}{2} = \frac{e^{2r} - 1^2}{2e^r} = \frac{1 - e^{-2r}}{2e^r}$$

For the state $g^2 \# 1^2$, $r = \gamma \beta$

$$\sinh \gamma \beta = \frac{e^{\gamma \beta} - e^{-\gamma \beta}}{2} = \frac{e^{2\gamma \beta} - 1^2}{2e^{\gamma \beta}} = \frac{1^2 - e^{-2\gamma \beta}}{2e^{\gamma \beta}}$$

$$\sinh (0) = \frac{e^0 - e^{-0}}{2} = 0, \quad b = 0$$

$$\cosh \gamma \beta = \frac{e^{\gamma \beta} + e^{-\gamma \beta}}{2} = \frac{e^{2\gamma \beta} + 1^2}{2e^{\gamma \beta}} = \frac{1 + e^{-2\gamma \beta}}{2e^{\gamma \beta}}$$

$$\cosh 0 = \frac{e^0 + e^0}{2} = 1$$
\[ I^2 = \cosh^2 r - \sinh^2 r = \cosh^2 r, \quad b = 0, \quad v = 0, \quad \sinh^2 r = 0 \]

Notice that the only difference between \( \cosh x \) and \( \sinh x \) is the sign in the numerator between \( e^x \) and \( e^{-x} \) which will determine whether the increase is due to a change in the total energy

\[
(\theta)^2 = \frac{\alpha^2}{2} \quad \text{initial condition} \quad \alpha \quad \text{or the interaction energy} \quad \frac{bg}{\frac{b^2}{g}} \quad \text{where} \quad g^2 = \cosh^2 \theta \quad \text{and} \quad (bg)^2 = \sinh^2 \theta \quad \text{where} \quad \theta = 2\pi r, \quad r \geq 1 \quad \text{so that} \]

\[ \cosh^2 q - \sinh^2 q = g^2 - (bg)^2 = 1^2 \]

In terms of the relativistic circle below, \( q = (2\pi r) \), so that integer multiples of \( q \) correspond to multiples of complete rotations of the circle; \( nq = (2\pi)nr \). In particular, note that \( n(2qr) = n(2\pi r) \) for \( r \) in radians, where the circumference assumes the role of relativistic (positive) “momentum”.

In this context, \( r^2 \) takes on the context of “energy”.

Initial State

\[
I^2 = \frac{1}{r^2} q^2 + \left(\frac{bg}{g}\right)^2 \quad \text{or} \quad g^2 = \frac{1}{3}q^2 + \left(\frac{bg}{g}\right)^2 \quad r = 1
\]
Initial State

\[ 1^2 = \frac{\left( cr \right)^2}{\left( cr \right)^2} \]

\[ \cosh^2 \theta = 1^2 + \sinh^2 \theta \]
In terms of the Binomial Expansion, the results are (in terms of the vector resultant r):

\[
\begin{align*}
\psi &= 1 + \beta \gamma = \phi \\
\psi^2 &= \gamma^2 = 1^2 + (\beta \gamma)^2 \\
\phi^2 &= \left[1 + (\beta \gamma)^2\right] = \left[1^2 + (\beta \gamma)^2\right] + 2\beta \gamma = \psi^2 + 2\beta \gamma
\end{align*}
\]

\[
\gamma^2 = 1^2 + (\beta \gamma)^2 \iff \gamma = \frac{1^2}{\sqrt{1^2 - \beta^2}}
\]

\[
A_0 = (1)^2, \quad A_{\Delta} = 4\left(\frac{1}{2}\right) \beta \gamma = 2\beta \gamma
\]

\[
\cos \theta = \frac{1}{\gamma}, \quad \sin \theta = \frac{\beta \gamma}{\gamma} = \beta \]

\[
\cosh \theta = \gamma, \quad \sinh \theta = \frac{\beta \gamma}{\gamma} \]

\[
\cosh^2 \theta = 1^2 + \sinh^2 \theta
\]
\[
\frac{c}{\tau} \cdot n = 1 \quad \forall \ c \cdot n = c \\
\]
Completeness of the Positive Real Number system

The relativistic circle is only defined if the initial condition exists, where \( \frac{(ct)^2}{ct} = \left(1_x\right)^2 \). The initial condition includes all possible products \( m_0 = ct \) of the positive numbers \( c \) and \( t \) in the set \( \{c, t\} = \{x\} \); note that this set does not include addition, so is not a complete descriptor of real numbers. In order to include addition which is valid for all possible real numbers, one must include a second set of real numbers with a valid multiplication (scaling) relation between them \( \{v, t\} = \{x\} \), where the multiplicative product \( xx' = x'x = (ct)(vt') \) is defined, as well as the additive relation

\[ j = (x + x') = (x' + x) = ct + vt' \] must be included in the characterization.

\[ \frac{1}{ct} (x + x') = c + \frac{1}{ct} t' = c + v' \]

\[ (x + x') = ct + (vt)g = ct + \frac{v}{c} ct \frac{g}{b} g = ct + (bct)g = ct \left(1 + bg\right) \]

Then \( x = ct \overset{?}{=} x' = 0 \); i.e., \( b = 0 \), which is true only for \( q_{x,x'} = 0 \) and \( q_{x,x'} = p \) (these conditions account for the factor of 2 in the product \( 2( xx') \)

Multiplication must also hold for the real numbers, so the expression

\[ j^2 = (x + x')(x + x') = x^2 + x'^2 + 2xx' \] must also be valid so that

must also be valid, where both sums and products commute:

\[ x + x' = x' + x \] and \( xx' = x'x \)

This is the Binomial Expansion for the case \( n = 2 \)

The multiplicative product \( 2xx' \) can be eliminated with the introduction of the complex conjugate, so that \( y^2 = (x + ix')(x - ix') = x^2 + (x')^2 \), where it is important to emphasize that \( x \) is the initial condition in this context \( \{c, t\} = \{x\} \). If there is no initial condition, then \( \{x\} \) is not defined, so the equation \( x'' = \frac{x'}{x} \) is not defined for \( x = ct = 0 \)

The Fundamental Equation of Special Relativity is given by the linear relation that encompasses the complete set of real number where both addition and scalar multiplication are included:
\[(ct')^2 = (vt')^2 + (ct)^2\], where the set \(\{c, t, v, t'\}_{x, x'} = \{x, x'\}\) now includes both addition and multiplication.

In the case of the Final State solution of this equation is represented by

\[1^2 = \frac{\xi_1}{\xi_2} + b_{x'}^2\], where the final result is independent of both \(g_x\) and \(b_{x'}\) with the proviso that \(g_x = x_x = \cos\theta\) must always be greater than zero; otherwise there is no initial system to begin with. In particular, \(0 \leq b_{x'} < 1\) for a single system.

For the Initial State solution, the equation becomes \(g^2 = 1^2 + (b_x g_{x, x'})^2\), where the initial condition is \(1^2\) but \(g_{x, x'}^2 \neq 1^2\), where \(g^2\) is now the final condition. Then \(g_{x, x'}^2 - (b_x g_{x, x'})^2 = 1^2\) so that \(g_{x, x'}^2 (1^2 - b_{x'}^2) = 1^2\) and finally

\[g_{x, x'}^2 = \frac{1^2}{(1^2 - b_{x'}^2)}\] where there is no interaction term explicit in the equation. However, the condition \(0 \leq b_{x'} < 1\) applies for the relativistic unit circle to be consistent.

Therefore, the Fundamental Equation of Special Relativity describes only a single system \(\{c, t, v, t'\} = \{x\}\) where both operations \(x'' = x + x'\) and multiplicative operations \(x'' = (x)(x')\) are included, where \(\{x, x', x''\} \not\subset \{x\}\)

Therefore, the Binomial Expansion

\[(j_{x, x'})^n = (g_{x, x'} + b_{x'})^n = (g_{x, x'})^n + (b_{x'})^n + rem(g_{x, x'}, b_{x'}, n)\] can only be an integer for \(b_{x'} = 0\), so that \((j_x)^n = g_{x}^n = 1^n\) and \(x(j_x')^n = x(g_{x}^n) = x(1^n)\) for all \(x \not\subset \{x\}\). Another way of expressing this is

\[(j_{x, x'})^n = (x'')^n = (x + x')^n = x'' + (x')^n + rem(x, x', n)\], which can only be single valued for \(rem(x, x', n) = 0\) which implies \(x' = 0\) so that \((j_x)^n = (x'')^n = x''\)

That is, the final state is equal to the initial state \((t' = t)_{x}, g_{x} = 1, v = 0, b_{x'} = 0\) in the solution to the fundamental equation of Special Relativity:
\( (t' = t_\xi) \), \( g_x = \frac{1}{\sqrt{1 - b\xi^2}}, b_x = \frac{\xi}{c}, b'_x = \frac{\xi}{c} \). Then \( g = \frac{1}{g} = 1 = i, b = 0 \) is the unit basis for the system \( x = xi \). If negative half-axis is included, then \( 2 \mathfrak{A}^2 (0) \mathfrak{B} = 2 \mathfrak{A}^2 (-i) \) where \( \mathfrak{A} = \mathfrak{q}, \mathfrak{B} = 0, \mathfrak{P} \) where the null vector indicates that the basis vectors commute, which means that the model is of two independent relativistic unit circles (where only the second order is included in the model, consistent with Einstein’s elimination of momentum in his modification of the Lorentz transform).

If the system is restricted to integers, then \( a_x = ai \) where \( a \) is a variable that includes all the integers in the set \( \{a\} \subseteq \{x\} \).

In order to compare another complete set of integers, a separate set \( \{b\} \subseteq \{y\} \subseteq \{c, v, t, t'\} \) must be included. In order that all operations of addition and multiplication be included in the resulting single valued set \( \{c\} \), the Binomial Theorem again applies, where

\[ j'' = (x + y)^n = x'' + y'' + \text{rem}(x, y, n) \] where the expression \( y'' = x'' + y'' \) if and only if \( \text{rem}(x, y, n) = 0 \). This means that \( x = 0, y = 0 \) or \( x = y = 0 \) for \( n > 2 \), thus proving Fermat’s Theorem for the special cases of \( a \subseteq \{x\} \) and \( b \subseteq \{y\} \).

For \( n = 2 \), the interaction term \( 2ab \) can only be eliminated by the complex expression

\[ y^2 = (a + ib)(a - ib) = a^2 + b^2, \quad i = \sqrt{-1} \]

For \( x = xi \), \( y = y j \), the equation becomes

\[ j^2 (r \cdot r) = x^2 |j \cdot i| + y^2 |j \cdot j| + 2xy |k \mathfrak{f} k| \]

So that

\[ j^2 r^2 (0) = x^2 (0) + y^2 (0) + 2xy (0), \] where the null vector indicates that all elements commute.

Then

\[ j^2 = \frac{1}{r^2} k x^2 + y^2 + 2xy \frac{2}{3} \]
And if \( 2(x \cdot y) = 0 \), then \( y^2 = \frac{1}{r^2} 4x^2 + y^2 = \frac{r^2}{r^2} = 1,^2 \) \( \) However, for the real number system of independent real numbers \( \{x\} \) and \( \{y\} \) the cross product remains, since \( \{x\} \{y\} \).

This condition also applies to the general Binomial Expansion \( n \# 2 \), where

\[
\hat{j}^n \left(r^* r \ldots r\right)_n = x^n \left|i\right| + y^n \left|j\right| + \text{rem}(x, y^n) \left|k\right|
\]

So that

\[
\hat{j}^n r^n (0) = (x + y)^n r^n (0) = x^n (0) + y^n (0) + \text{rem}(x, y, n) (0)
\]

And

\[
\hat{j}^n = \frac{4}{3} \frac{1}{r^2} 4x^2 + y^2 + \text{rem}(x, y, n) 2 = \frac{4}{3} \frac{1}{r^2} 4x^2 + \text{rem}(x, y, n) 2
\]

Where \( \hat{j}^n = 1^n \) (so that \( z = z(1^n) \)) only if \( \text{rem}(x, y, n) = 0 \), which again means that \( \{x\} = \{0\} \), \( \{y\} = \{0\} \) or \( \{x\} = \{y\} = \{0\} \).

Again, the case of Pythagorean triples in a single real number set is an artifact of additive counting, where the actual values will depend on the base of the number system selected.
Single-Valued Real Number Systems

Consider a single complete positive real number system \( \{ c, v, t', t \} \not\subset \{ x \} \), where the initial and final states are defined by \( g = \frac{ct}{ct} \) and \( g' = \frac{ct'}{ct} \), respectively.

Then consider the relation:

\[
\mathbf{j}^2 = (g + g')^2 = g^2 + (g')^2 + 2gg'
\]

Then the interaction product can be eliminated if either \( g' = 0 \) or an imaginary interaction is added and subtracted to the real number system so that \( y^2 = (g + ig')(g - ig') = g^2 + (g')^2 \). In the first case, the final state has been eliminated (there is only one state; the initial state), and in the second case, the final state is given by

\[
(g')^2 = \frac{1}{\mathbf{1}-b^2} \# 1^2 , \text{ which is never less than one, and only equal to one for } b = 0
\]

Then \( \mathbf{j}^2 = (g + g')^2 = g^2 + \frac{1^2}{(1^2 - b^2)} = g^2 + \frac{1^2}{(1^2 + (ib)^2)} = g^2 + \frac{1^2}{(1^2 + (b')^2)} \), \( b' = ib \)

So that \( \mathbf{j} \) can be single valued only if \( b = 0 \) or \( b' \) is imaginary. Therefore, for \( x \) to be single valued,

\[
x = x\mathbf{j} = xg \quad \text{and} \quad g = \mathbf{j} = 1 \quad \{ c, t \} \not\subset \{ c, t \} \not\subset \{ x \} \quad \text{which is also true for the case of integers } \{ a \} \not\subset \{ x \} .
\]

The same conditions hold for \( \{ c, t \} \not\subset \{ c, t \} \not\subset \{ y \} \) independent of \( \{ x \} \) in the Cartesian space \( \{ x \} \not\subset \{ y \} \), where a single valued function \( \{ z \} = f (\{ x \}, \{ y \}) \) is a vector mapping between the two sets of real variables characterized by the direct sum \( \{ z \} = \{ x \} \not\subset \{ y \} \) and the cross product \( \{ z \} = \{ x \} \not\subset \{ y \} \)

For the case \( n = 2 \), the Binomial Theorem is then characterized by the map

\[
\{ z \}^2 = \begin{vmatrix} x^2 \end{vmatrix} \not\subset \begin{vmatrix} y^2 \end{vmatrix} \not\subset 2 \left[ \begin{vmatrix} x \end{vmatrix} \not\subset \begin{vmatrix} y \end{vmatrix} \right] \quad \text{for positive real numbers, where the absolute value means that the sets commute and so all are characterized by the null vector:}
\]

\[
\{ z \}^2 = \begin{vmatrix} x^2 \end{vmatrix} (0) \not\subset \begin{vmatrix} y^2 \end{vmatrix} (0) \not\subset 2 \{ x \} \{ y \} (0) \quad \text{so that}
\]

\[
\{ z \}^2 = \begin{vmatrix} x^2 \end{vmatrix} \not\subset \begin{vmatrix} y^2 \end{vmatrix} \not\subset 2 \{ x \} \{ y \} (0) \quad \text{which can then be represented by}
\]
\[ z^2 = \frac{1}{r^2} \frac{\hat{x}^2 + y^2}{3} + 2xy \] provided that the vector nature (i.e., independency) of the pair \((x, y)\) is understood, and finally if \( z = z_1 = zr_z = zr_1, \ r = 1 \) the result becomes

\[ z^2 = x^2 + y^2 + 2xy \] where \( z \) now characterizes a final “resultant” dimension.

If the interaction between the sets is eliminated, then

\[ z^2 = \frac{1}{r^2} \frac{\hat{x}^2 + y^2}{3} \] which is an “inverse square law”. Furthermore if the relation between the sets is restricted to a linear relation, so that \( \{y\} = A \{x\} \) where \( A \) is a positive real number (a “slope”, or derivative in the equation of a line \( y = Ax + b \) where \( b = 0 \) (so the line passes through the common origin \( (0, 0) \)), then

\[ z^2 = \frac{1}{r^2} \frac{\hat{x}^2 + A^2 x^2}{3} + \left( \frac{1 + A^2}{r^2} \right) \frac{\hat{x}^2}{3} \] and \( z^2 = (1 + A^2) \frac{\hat{x}^2}{r^2} \frac{2}{3} \), where \( 1 + A^2 \) is the coupling constant between the linearly related sets \( \{x\}, \{y\} \). For Quantum Mechanics, this represents the relativistic relation between photo-equivalent masses \( g_x = h_x = \frac{E_x}{t_x} \) and \( g_y = h_y = \frac{E_y}{t_y} \).

Then \( A > 0 \) represents the charge to mass contribution

\[ z^2 = \frac{1}{r^2} \frac{\hat{x}^2}{3} + \left( \frac{1 + \frac{b_y}{g_{x,y}}}{r^2} \right) \frac{\hat{x}^2}{3} \] to two systems with identical initial conditions \( g_x = g_y \) so that \( b_{x,y} \) represents the additional factor resulting from mixing the two systems

\[ (b_{x,y})^2 = \sin^2(q_x + q_y) = \sin q_x \cos q_y + \sin q_y \cos q_x \] (mapping \( g_x \) and \( g_y \) onto the vectors \( \langle i, j \rangle \) so that \( g_x \cdot g_y = 0 \) and \( (g')^2(0) = [g_x \cdot g_y](0) \) so that

\[ (g')^2 = 2 g_x g_y \frac{2}{3}, \] which characterizes the interaction product between \( \{x\}, \{y\} \) where

\[ (j_{x,y})^2 = (g_x + g_y)^2 = (g_x)^2 + (g_y)^2 + 2g_x g_y. \] For the interaction product to vanish, the initial
condition(s) must vanish for one of the sets i.e., \( g_x = 0, \ g_y = 0 \) or both \( g_x = g_y = 0 \), in which case there are no real numbers... or the imaginary interaction is added and subtracted so that

\[
(y_{x,y})^2 = (g_x)^2 + (g_y)^2 = (g_x + ig_y)(g_x - ig_y)
\]

In the case \( n > 2 \), the result is \( (j_{x,y})^n = (g_x)^n + (g_y)^n + \text{rem}(g_x, g_y, n) \) where the interaction product cannot vanish unless \( g_x = 0, \ g_y = 0 \) or both \( g_x = g_y = 0 \) as above, but the result does not admit the addition and subtraction w.r.t. complex numbers available in the case \( n = 2 \) (i.e., the resultant set is non-linear.

If \( \mathbf{f} = \text{rem}(g_x, g_y, n) = \sqrt[n]{\text{rem}(g_x, g_y, n)} = \sqrt[n]{\mathbf{f}} \) then \( \mathbf{f} \) can be characterized as the non-linear contribution to \( y_{x,y} \), where the interactive products in \( \mathbf{f} \) are characterized by \( \sum_{k=0}^{n} \frac{n!}{k!} A^{n-k}(x^n) \). For \( y = kx = Ax \), the relation becomes

\[
(j_{x,Ax})^n = (x + y)^n = (x + Ax)^n = (1 + A)^n x^n = \sum_{k=0}^{n} \frac{n!}{k!} A^{n-k}(x^n)
\]

where \( A \) is the charge-to-mass ratio \( A = \frac{b}{g} \), so that for \( dA = d \) the equation becomes

\[
j^n = (x + y)^n = (x + dx)^n = (1 + d)^n x^n = \sum_{k=0}^{n} \frac{n!}{k!} d^{n-k}(x^n)
\]

where \( d \) is now the non-linear contribution to \( (j_{x,Ax})^n \), and thus characterizes non-linear spin relationships in the context of two-body expansions modeled by real numbers as a vector potential.

**Note that for the case** \( n = 2 \) \( j^2 = (x + Ax)^2 = x^2 + (Ax)^2 + 2Ax^2 = x^2 (1^2 + A^2 + 2A^2) \) so separation of charge and mass requires \( A = 0 \); that is, they cannot be separated in energy even if the interaction is linear in the relativistic model.

For the relativistic Electromagnetic Field Tensor, this is the requirement that \( \frac{\partial A}{\partial x} = \frac{\partial A}{\partial x'} = 0 \); that is Vector Potential \( A \) is independent of mass in either its initial or final state. Therefore, the non-relativistic Field Tensor only describes a change of state during the change, but where the change is equal and opposite (corresponding to the null vector). So that the expression \( 2A^2 \) represents the interaction of the field with itself (corresponding to \( 2EB = 2A^2 \) where \( E = B = A \) so that
\[ A^2 = (E^2 + B^2) = E^2 + B^2 + 2EB. \] Eliminating \( EB \) so that \( A^2 = 0 \) means that \( E = B = 0 \) so that electromagnetism is eliminated w.r.t. both initial and final states (i.e., \( \mathbf{ct} = \mathbf{ct}' \)) in the real number system \( \{x\} = \{x\}_i \).

Therefore, the gauge condition is irrelevant in a system of one set of real where the perturbation is linear, since in that case \( |A| = \sqrt{A^2} = 0 \) if charge is independent of mass in the relativistic formulation.

This is also true for the independent sets \( \{y\} = \{y\}_j \) and \( \{y\} = \{y\}_k \), so if charge is independent of mass in all three “dimensions”, \( \{r^2\}(0) = \{x^2\}(0) \bowtie \{y^2\}(0) \bowtie \{y^2\}(0) \) so that

\[
(m_0)_r^2 = (h_\phi)^2 = (\mathbf{ct})_r^2 = (\mathbf{ct'})_r^2 = (t^2) = \frac{1}{r^2} (x^2 + y^2 + z^2), \text{ where } (x^2 + y^2 + z^2) = r^2 \text{ is the radius of the Universe, a galaxy, or a photo-equivalent system (a “photon”) corresponding to a “Black Hole” at the Planck “length” and } \{x, y, z\} \text{ corresponds to three “dimensions” of complete sets of real numbers where the initial and final conditions are their respective unit vectors, and the relation is mapped to a single value in the resultant “dimension” } \{r^2\}(0) \text{, where the null vector represents an “equal and opposite” “radius”}. \]

For additional particles model to be included in the linear model, the relation now becomes a multinomial, where

\[
\mathbf{j} (x, Ax, Bx, ..., Mx)^n = (x + Ax + Bx + ...Mx)^n = x^n + \mathbf{d}(x, A, B, ..., M) \text{ where again } \mathbf{j}^n = x^n \text{ (i.e., single valued) only if } \mathbf{d}(x, A, B, ..., M) = 0. \text{ That is, if the distinction is made between mass and charge, there is no charge, only mass, so there is no Lorentz force; that is, no interaction between particles of linearly related masses in terms of the same initial condition if the interaction is electromagnetic. \]

It should be understood that the relation \( m_0' = Am_0 = A(\mathbf{ct}) = A(h) \) actually is a relativistic force where \( F = m_0' = Am_0 = A(\mathbf{ct}) = Ah \) and so is a linear “acceleration” to the “rest” mass (or initial condition) where \( A \neq 1 \) for \( m_0 = \mathbf{ct} \) as the initial condition in terms of the fundamental equation of Special Relativity.

In order to include particles with different charge to mass ratios, one simply expands the set \( \{A, B, ..., M,...\} \) so that \( \mathbf{d}(x, A, B, ..., M,..) \) includes more photon-equivalent interactions based on the same initial condition \( m_0 = \mathbf{ct} \).
It is this initial condition that is sometimes referred to by some as the “Big Bang”, by others as an independent “Black Hole”, and by still others as “the event that occurred just before the gleam in your father’s eye faded..."

**Philosophy**

The basic context of Einstein’s perspective is the creation of the Universe from the command (by “someone”, “somewhere”, “somewhen” – maybe, even if it is only Descartes’ dictum “I think, therefore I am”): Let there be light” from nothing. The question then becomes the nature of the source.

**Subjectivity**

Subjectively, the “speed” of light is instantaneous in ordinary experience, and we don’t feel the “mass” of light unless we get a sunburn. In a similar way, we don’t feel “force” unless we have a physical experience – being hit on the head, or indigestion, or (for some of us) having a baby.

Therefore, this experience can be summarized by naïve solipsism and naïve realism; the “Wow” of physics, only light (“far out, look at all the colors”), and the “Ow” of physics (“I didn’t see that coming, but it hurts”). Descartes should have added “I also feel, therefore I am – I think, anyway..."

“I think, therefore I am” – Descartes

“I am, therefore I think” – Stephen Hawking

“I think, therefore I think”- Hegel

“I am, therefore I am” – “Stone Cold” Steve Austin and the rest of WWE, Popeye, et.al.

According to some, The “Wow ” of physics and the “Ow” of physics can be combined to produce the “Tao” of physics, provided interactions between them are included in the analysis.

For Clerk Maxwell, the concepts were combined in his result \( c = \frac{1}{\sqrt{\varepsilon_0 \mu_0}} \), derived from the electromagnetic force equations of Ampere and Coulomb (with help from Faraday), with the postulate of “displacement current” in space and time, from the symmetries inherent in Greens’ and Stokes theorems using “dot” and “cross” products (in terms of volumes and surfaces) in terms of a “space-time aether” between imaginary plates of a theoretical capacitor.

**Introduction to Einstein (The Characterization of Mathematical and Physical Constants)**

**The “One Source” Mass model of Quantum Mechanics**

Einstein was instrumental (and was awarded the Nobel prize) for his characterization of the “Ow” of physics in terms of the light-equivalent photo-electron using Planck’s constant:
\[ E = mc^2 = \frac{\hbar}{c} \] which resulted in the famous \( E = mc^2 = h_c \) which is the foundation of Quantum Mechanics, Special Relativity, and Quantum Field Theory. Einstein's declaration of “c” as a constant eliminated the space-time difficulties in Maxwell's equations (making any relation between \( c_0 \) and \( m_b \) irrelevant, and therefore Maxwell's derivation). In this context, the fundamental equation of mass creation is

\[ c\frac{dt_c}{d\tau} = \tau \quad \text{For Quantum Mechanics, } h_c = c_h = E_c \] so that \( c_h = E_c \). Therefore, Planck's constant is the single source of energy in the Universe.

In doing so, Einstein combined the “Wow” (light) and the “Ow” (mass) of physics into a “Tao” of physics, where the interaction can never be observed subjectively, and so must be imagined (i.e., “theorized” based on experimental models). Note that this model is independent of (subjective) space and time, and therefore rejects the experimental model of Maxwell's derivation, only referring).

(Note that Newton's laws for momentum are related by \( P = m\vec{v} = m\vec{\frac{\vec{v}^2}{c^2}} \) and \( E = m\vec{v}^2 = m\vec{\frac{\vec{v}^2}{c^2}} \), which also results if \( c = 1 \)).

It is of fundamental importance to emphasize that in this one source model Einstein rejects Newton's momentum \( P = m(\pm \vec{v}) \) so that only positive energy is included.

Therefore, in the equation \( h_c = c_h = E_c \) all parameters are positive definite.

The “Two Source” Mass model of Special Relativity

This model assumes an Initial Condition with \( m_c = ct_c \) (as a primary source), an independent Perturbation \( m'_v = \vec{v}t' = \vec{v}d\tau \) as a second source with a final result characterized by \( m' = ct' \). The relation is governed by the linear relation \( (ct')^2 = (\vec{v}t')^2 + (ct_c)^2 \) so that the equation

\[ (ct')^2 (r' r) = (\vec{v}t')^2 (i^2 i) + (ct_c)^2 (j^2 j) \] so that

\[ (ct')^2 r^2 (0) = (\vec{v}t')^2 (0) + (ct_c)^2 (0) \] if the dot product is characterized by equal and opposite interaction between the basis vectors of each dimension (and the resultant), so that
\[
(\mathbf{ct}')^2 = \frac{1}{r^2} u(\mathbf{vt}')^2 + \left(\mathbf{ct}_c\right)^2 \frac{2}{3}
\]
If \( r = 1 \) is taken as the basis vector in a resultant dimension (not characterized by \( i \) or \( j \) individually, then the equation becomes

\[
(\mathbf{ct}')^2 = u(\mathbf{vt}')^2 + \left(\mathbf{ct}_c\right)^2 \frac{2}{3}
\]

(1.1)

, which characterizes a final state \((\mathbf{ct}')^2\) as the sum of two independent sources; an initial state \((\mathbf{ct})^2\) and an “interaction” state \((\mathbf{vt}')^2\).

It is important to emphasize that by declaring “\( c \)” to be a constant, Einstein was implicitly declaring the equation \( h = c t \), \( t = 1 \) as the initial condition, in terms of which all Quantum Physics is then to be interpreted.

The expression \( E_{c,n} = n_c h_c \) is an expression of a final state for \( n_c \) elements of final “action” \( h_c \), which is then further modified to the expression \( E_{c,n,a} = (n_c h_c)u \), which is the final state of \( n_c \) photons at a given frequency \( u \). This can be further modified by the function of a spectrum (continuous or discrete) to show the relation of this set as a function of temperature, volume, etc., where each element, if taken to be a constant, is an expression of its final state.

Finally, this can be related to the state of our subjective experience if \( x = ct \) if \( (x = ct) \equiv (m_c = ct_c) \), where \( (x = ct) \) represents the “Wow” of physics, and \( (m_c = ct_c) \) represents the “Ow” of physics.

This interpretation suggests that \( c \) and \( v \) are independent mass creation rates, and so form a vector space \((c,v)\). In order for a linear relation to be true for all values, the vector space is related by the scaling variables \( t \) and \( t' \), so the resulting vector space is then characterized by the pair \((c t, c t')\), and the resultant is calculated from the relation above.

The set of positive field variables \( \{c,v,t,t'\} \) cover a two dimensional vector space of positive real numbers \((x,y)\) where \( x \equiv c t \) and \( y \equiv c t' \) so the equation \( r^2 = x^2 + y^2 \) corresponds to the vector relation above, and is the well-known equation of a circle.

Equation (1.1) has three possible solutions:

1. The “Time Dilation” equation. Solving for \( t' \) results in the relation

\[
t' = tg, \quad g = \frac{1}{\sqrt{1-b^2}}, \quad b = \frac{v}{c}; \quad \text{a relation between the scaling factors } t \text{ and } t' \text{ in terms of } b.\]
2. Final State Solution. Dividing the equation by the final state \((ct')^2\) results in the “relativistic unit circle”:

\[
1^2 = \frac{\tau^2}{\tau^2} + \frac{\tau^2}{\tau^2} = \frac{\tau^2}{\tau^2} = \frac{\tau^2}{\tau^2}
\]

Here \(1^2 = \frac{(ct')^2}{\tau^2}\) is interpreted as the final state resulting from the initial state \(\gamma^2 = \frac{c^2}{\tau^2} = \frac{1}{\gamma^2}\), where \(\tau = \tau'\) is interpreted as no interaction from a perturbing state \(b = 0\).

3. Initial State Solution. Dividing the equation by the initial state \((ct)^2\) results in the

\[
g^2 = \frac{\tau^2}{\tau^2} + \frac{\tau^2}{\tau^2} = bg + 1^2.
\]

It is important to note that the product \(bg\) appears in the Initial State solution, but is absent in the first two solutions.

If the relativistic unit circle is postulated that all four quadrants are positive, each full rotation of the radius \(r = \frac{ct}{ct'} = 1\) characterizes an additional unit integer from the initial unit integer \(r = \frac{ct}{ct} = 1\), where \(r'\) and \(r\) characterize the final and initial states of the system, respectively. Each rotation begins and ends with \(v = 0\), but rotation through each of the four quadrants results in the additional “spin” \(s = 2gb\) which increments cumulatively during a quadrant rotation of \(\gamma^2 = \frac{P}{2}\). Because all four quadrants are positive, there is no distinction in direction of rotation, so that “equal and opposite” rotations result in the null vector \(0\) for each rotation of \(2p\). At the end of each rotation, the integer count is incremented by 1, so that \(n = ng\), \(g = 1\). This relation is true for all elements \(\{c,v,t,t'\} \neq \{a\}\), represented colloquially by the variable \(a\) (or \(x\) in the case of real numbers.)

(The positive relativistic unit circle characterizes bosons and are called “spin 1”; If the relativistic circle is divided into positive and negative (upper and lower half planes), negative integers can be created, which is why fermions have half-spin, where positive and negative integers are created each half of a rotation).

The set of integers are then generated within the set of field variables \(\{a\}\)

\[
\{c,v,t,t',n\} = n\{c,v,t,t'\}, \quad \text{where it is understood that the set also applies to real numbers} \quad \{x\}.
\]

so that \((nx)g = nx, \quad g = 1\)

If \(n\) such individual sets of \(\{x\}\) are thus characterized, the area of the total system grows as

\[
A_n = n(r')^2 = n(x^2), \quad \text{where the exponent represents the fact that two dimensions (representing the}
\]
initial state and the final state) are at play in creating the additional sets, in which it is assumed that the relation between the initial and final states is linear (the final state encompasses all possible “permutations” \( vt \) within the set \( \{ c, v, t, n \} \).

The overall set \( \{ c, v, t, t', n \} \) can then be characterized as a “dimension”, with unit vector

\[
i = 1 = \frac{c}{c} \frac{\mathbf{t}}{\mathbf{t}} \quad \text{for the first integer, and} \quad a_i = a = a = a = a = a = a = a = a = 1 \text{ integer rotations in the system},
\]

and similarly for the real numbers \( \{ x \} \), where the initial states and final states are equal at \( t = t' \) (characterizing a single “type” of particle based on the initial condition), but the system count is incremented by unity for each rotation. Since all elements are positive, there is no “subtraction”, and the rotations are always increasing the count incrementally.

Consider a second system \( \{ c, v, t, t', n \} = \{ b \} \) that is independent of \( \{ a \} \), so that the system is characterized by

\[
j = 1 = \frac{c}{c} \frac{\mathbf{t}}{\mathbf{t}} \quad \text{and} \quad b_j = b_j = b_j = b_j = b_j = b_j = b_j = b_j = b_j = 1 \text{ and similarly for } \{ y \}.
\]

If both sets are independent and are characterized by a common value of \( c_a = c_b \), then the result of their creation for the cases where \( t_a = t_b \) and \( v_a = v_b \) can be characterized by the equation

\[
y = a^2 + b^2, \quad \text{where the sets } \{ a \} \text{ and } \{ b \} \text{ do not interact, so that } (m)y = m(a^2 + b^2), \quad \text{and similarly for real numbers } y = x^2 + y^2.
\]

However, if \( \{ a \} \) and \( \{ b \} \) do interact during their integer creation cycles, then the relation is given by

\[
\mathbf{J}_{a,b}^2 = g_{a,b}^2 + b_{a,b}^2 + 2 b_{a,b}^2 \cos\varphi, \quad \text{where } g = \cos\varphi \text{ and } b = \sin\varphi \text{ during each of the rotation cycles, which results in the relation}
\]

\[
\mathbf{J}_{a,b}^2 = a^2 + b^2 + 2ab \quad (\mathbf{J}_{a,b}^2 = x^2 + y^2 + 2xy) \text{ where at least one of the elements in } \{ c, v, t, t' \} \neq \{ a \}
\]

is different from that in \( \{ b \} \). This difference is represented by \( b = \sin\varphi = \frac{v}{c} \mathbf{p} \mathbf{0} \), where \( b_a \mathbf{p} \mathbf{b}_a, (b_c \mathbf{p} \mathbf{b}_c) \), corresponding to the model that the axes \( (a, b) \) or \( (x, y) \) are not independent (i.e., orthogonal), and thus constitute an “acceleration” between the two systems (characterized as “gravity” by Einstein).
It is this interaction that is represented by the “inverse square law” of two particles, where only the interaction is modeled, so that \( r^2 = 2ab \) and \( (1)^2 = \frac{2}{r^2} (ab) \) where \( \frac{2}{r^2} \) is the coupling constant for the interaction between the sets \( \{a\} \) and \( \{b\} \), and is called “spin” in Quantum field Theory (for bosons, the “spin” is equal, opposite, and positive definite).

For \( n \) such interactions, the equation becomes

\[
(j_{a,b})^n = (a + b)^n = a^n + b^n + \text{rem}(a, b, n) \quad \text{(corresponding to} \quad (j_{x,y})^n = (x + y)^n = x^n + y^n + \text{rem}(x, y, n) \quad \text{, where the terms} \quad \text{rem}(a, b, n) > 0 \quad \text{and} \quad \text{rem}(x, y, n) > 0 \quad \text{(thus proving Fermat’s Theorem in the case of integers).}
\]

Within the unit circle, this corresponds to the equation

\[
\hat{j}^2 = \sum_{\alpha} a_{\alpha}^2 + \sum_{\beta} b_{\beta}^2 + 2 \sum_{\alpha, \beta} a_{\alpha} b_{\beta} = (1) + 2 \sum_{\alpha, \beta} \sqrt{a_{\alpha} b_{\beta}}
\]

This can also be linear as a new “final result for \( \frac{2}{r^2} = \sum_{\alpha} a_{\alpha} b_{\beta} \), so that \( r_{a,b} = \sqrt{2 \sum_{\alpha} a_{\alpha} b_{\beta}} \), so that \( r_{a,b} \) cannot be an integer even if \( b = g = \frac{1}{g} = 1 \) for the case of two systems interacting.

The interaction is therefore ignored in Fermat’s expression \( y^2 = a^2 + b^2 \) (implying that Pythagorean triples are an artifact of counting in one dimension, where the values are dependent on the base of the numbers system in that system). The interaction can be eliminated by introducing a complex “destruction” mechanism where \( y^2 = a^2 + b^2 = (a + ib)(a - ib) = y^*y \), which is the foundation of the “wave” equation in Quantum Mechanics, so that \( y^2 = (\cos q_{a,b} + i \sin q_{a,b}) (\cos q_{a,b} - i \sin q_{a,b}) = \cos^2 q_{a,b} + \frac{g_a}{g_b} = 1 \), where \( q_{a,b} \) is the “mixing” angle between the two systems and \( q_{a,b} = 0, y = 1 \).

Therefore, all mathematical and physical constants are characterized by relation between the initial and final states of the relativistic unit circle, so the Binomial Theorem represents all real numbers where multiplication between two independent variables are concerned. This concept can then be expanded to the Multinomial Theorem; which can be invoked to prove (or disprove) Euler’s Conjecture.
The Creation and Destruction Functions

For Einstein, the function in creating the Universe must be positive definite; the “creation” function of the Universe is then

$$ \mathbf{j} = | \mathbf{j}| = \mathbf{j}^2 $$

so that the Universe is built from nothing: $$ \mathbf{j}^2 = 0 + \mathbf{j}^2 $$

Since this function is absolutely positive, it can only be destroyed by the “destructor” function:

$$ (i \mathbf{j})^2 = i^2 \mathbf{j}^2 = -\mathbf{j}^2 $$

so that $$ \mathbf{j}^2 + (i \mathbf{j})^2 = \mathbf{j}^2 + i^2 \mathbf{j}^2 = \mathbf{j}^2 + (-\mathbf{j}^2) = 0 $$

The Special Theory of Relativity (STR) is only concerned with the creation function. (This is also true of the General Theory, the Minkowski metric), where the Riemann Manifold is positive definite for all derivatives, so that

$$ \mathbf{j}_{i,j} = (\frac{1}{ff_{i,j}} + (ff')_{i,j})^2 $$

where $$ (y')_{n} = (\frac{1}{ff_{i,j}} + (ff')_{i,j}) $$ represents the metric tensor, which is

linear only in the case of $$ n = 2 $$

Thus all Experience (the “$\mathbf{j} = \text{Tao}$” of physics) can be characterized by the equation

$$ \mathbf{j}^n = (\text{"ow"}^n + (\text{"wow"}^n) + \text{rem}(\text{"ow"},\text{"wow"},n) $$

where $$ \text{rem}(\text{"ow"},\text{"wow"},n) $$ can only be eliminated by the complex conjugate $$ y^2 = (\text{ow})^2 + (\text{wow})^2 = [\text{ow} + i(\text{wow})] + [\text{ow} - i(\text{wow})] $$, or conversely $$ y^2 = (\text{wow})^2 + (\text{ow})^2 = [\text{wow} + i(\text{ow})] + [\text{wow} - i(\text{ow})] $$, where the specification of the initial condition is up to the imagination.... Finally, note that this elimination of the interaction is not possible for $$ n > 2 $$, where $$ \text{rem}(\text{"ow"},\text{"wow"},n) = 0 $$ if and only if $"\text{wow}" = 0$ or $"\text{ow}" = 0$, or both (in which case $\mathbf{j} = \text{Tao} = 0$, and $\text{Tao}$ (whatever it is) does not exist....
Appendices

A. Fermat’s Proof from Relativity

\[ g_{ij} = l_i + (b_{g_i})_j, \quad g_i(0) = \frac{1}{r_i} + (b_{g_i})_j^2(0), \quad g_i = \frac{1}{r_i} + (b_{g_i})_j^2 \]

\[ (y_{i})^2 = (g_{i})^2 = \frac{\frac{1}{g_i}^2}{y_i^2} = (b_{g_i})_j^2 + (g_{b_i})_j^2 \]

\[ (j_{i})^2 = \frac{\frac{1}{g_i}^2}{y_i^2} = (b_{g_i})_j^2 + (g_{b_i})_j^2 \]

(b, g, b, a are not integers

\[ (\phi_{i})^2 = (\phi_{j})^2 = \frac{\frac{1}{g_i}^2}{y_i^2} = (b_{g_i})_j^2 + (g_{b_i})_j^2 + 2(g_{b_i})_j^2 \]

(note: setting \( g_i = h_i \) fixes the multiplicative relationship for each \( i \), but information about \( g_i \) and \( b_i \) is lost)

Must be independent, or \( b_i = 0 \)

Two Systems

\[ (y_{i,j})^2 = (g_{i})^2 + (g_{j})^2 = \frac{1}{g_i}^2 + (g_{b_i})_j^2 + (g_{b_j})_j^2 \]

\[ (y_{i,j})^2 = 1^{d_i}, \quad b_i = b_j = 0 \]

\[ (j_{i,j})^2 = \frac{1}{g_i}^2 + (g_{j})^2 = \frac{1}{g_i}^2 + (g_{b_i})_j^2 + (g_{b_j})_j^2 \]

\[ (j_{i,j})^2 = (g_{i})^2 + (g_{j})^2 + 2(h_i)(h_j) \]

\[ (j_{i,j})^2 = 2, \quad b_i = b_j = 0, \quad h_i = h_j = 0 \]

Binomial Expansion

\[ \binom{n}{k} = \frac{n!}{k!(n-k)!} \]

\[ \binom{g}{g} = \binom{g}{g} = \binom{n}{k} = \frac{n!}{k!(n-k)!} \]

\[ \binom{g}{g} = \binom{g}{g} = \binom{n}{k} = \frac{n!}{k!(n-k)!} \]

\[ (j_{i,j})^n = \binom{g}{g} + (g_{j})^n = \binom{g}{g} + (g_{j})^n + 2 \text{rem}((g_{b_i})(g_{b_j}), n) \]
\[(\mathbf{j}_{i,j})'' = 2^a \geq b_i = b_j = 0; \quad h_i = h_j = 0\]

Three Systems

\[(\mathbf{y}_{i,j,k})^2 = (g_i)^2 + (g_j)^2 + (g_k)^2 = a^2 + (g_ib_i)^2 \frac{2}{3} a^2 + (g_jb_j)^2 \frac{2}{3} a^2 + (g_kb_k)^2 \frac{2}{3} a^2\]

\[(\mathbf{j}_{i,j,k})^2 = \mathbf{a}(g_i) + (g_j) + (g_k)^2 \geq b_i = b_j = b_k = 0; \quad h_i = h_j = h_k = 0\]

**N Systems** (for integer \(a\))

\[(\mathbf{j}_{i,j,k,\ldots})_a = \mathbf{j}_a = \mathbf{a}(g_i) + (g_j) + \ldots + (g_a) \frac{a}{3} \mathbf{g}_i\]

\[(\mathbf{j}_a)^a = \left(\mathbf{j}_{i,j,k,\ldots}\right)_a = a^a \geq b_i = b_j = b_k = \ldots, b_a = 0; \quad h_i = h_j = h_k = \ldots = h_a = 0\]

**N Systems** (for integer \(b\))

\[(\mathbf{j}_{i,j,k,\ldots})_b = \mathbf{j}_b = \mathbf{a}(g_i) + (g_j) + \ldots + (g_b) \frac{b}{3} \mathbf{g}_j\]

\[(\mathbf{j}_b)^b = \left(\mathbf{j}_{i,j,k,\ldots}\right)_b = b^b \geq b_i = b_j = b_k = \ldots, b_b = 0; \quad h_i = h_j = h_k = \ldots = h_b = 0\]

Note that \(g_i \cdot g_j \quad \ast \ast i, j\), which means that \(g_i \cdot g_j \) but \((\mathbf{g}_i, \mathbf{g}_j, 0)(0) = (\mathbf{g}_i, \mathbf{g}_j, 0)\)

\[(\mathbf{y}_{i,j})'' = (g_i)^a + (g_j)^a\]

\[(\mathbf{j}_{i,j})'' = (g_i)^a + (g_j)^a + \text{rem} (g_i, g_j, n) = (\mathbf{y}_{i,j})'' + \text{rem} (g_i, g_j, n) \) (Binomial Expansion)

\[\text{rem} (g_i, g_j, n) \mathbf{p} 0\]

\[(\mathbf{y}_{i,j})'' \mathbf{p} (\mathbf{j}_{i,j})'']
Fermat’s Theorem for n systems

Assume \(a, b, n\) positive integers.

\[
\left(\mathbf{y}_{a,b} \right)^n = (a + b)^n = a^n + b^n + \text{rem}\ (a, b, n) = \left(\mathbf{y}_{a,b} \right)^n + \text{rem}\ (a, b, n)
\]

Assume that for some integer \(c\) that

\[
\left(\mathbf{y}_{a,b} \right)^n = c^n = a^n + b^n \ (\text{Fermat’s Expression}), \text{ where } \{b\}_c = \{0\}
\]

\[
\left(\mathbf{j}_{a,b} \right)^n = \left(\mathbf{y}_{a,b} \right)^n \geq \text{rem}\ (a, b, n) = 0, \quad \forall a, b
\]

\[
\text{rem}\ (a, b, n) \neq 0 \text{ for any } a, b
\]

\[
\left(\mathbf{j}_{a,b} \right)^n = c^n \cdot \left(a + b\right)^n \ (\text{Proof of Fermat’s Theorem, and probably his}).
\]

QED
**Supplemental Topics**

**Vector Commutation and Spin**

If the coefficients of two vectors commute, the product becomes the coefficient of the null vector \((0)\), which represents scaling interactions: a “scaling” in the case of “dot” products

\[ a \cdot b = ab(0) = ba(0) \] (where the null vector is usually omitted)

and equal and opposite interaction in the case of cross products

\[ (a \mathbf{\times} b) \mathbf{\times} (b \mathbf{\times} a) = ab(k) + ba(-k) = 2ab(0) = 2ba(0) \]

where the factor of 2 represents the “spin” in the relation

\[ j^2(r \cdot r) = (a + b)^2 = a^2 + b^2 + 2ab |a \mathbf{\times} b| \]

\[ j^2 r^2 (0) = a^2 (0) + b^2 (0) + 2ab (0) \]

\[ j^2 r^2 = a^2 + b^2 + 2ab \]

\[ j^2 = \frac{1}{r^2} a^2 + b^2 + 2ab^2 \]

\[ D^2 = \frac{1}{r^2} [2ab] \]
For QFT, set \( r = 1 \), \( D = h^2 \) so that \( \frac{D}{\sqrt{E}} = \frac{h}{\sqrt{F}} = 1 = s \), where \( s \) represents the relativistic interaction between the two particles (if \( a = b \) then \( 2ab = 2a^2 \) and one can identify \( 1_a \) with \( (1_a)^2 = \frac{a^2}{a^2} \) so that

\[
(l_a) = \frac{a}{ct} = \frac{ct'}{ct} \quad \text{for the system } \{a\} = \{c, v, t, t'\}_a
\]

For \( r \neq 1 \),

\[
D^2 = \frac{1}{r^2} \cdot 2a^2 = \frac{2}{r^2} (a_1)^2
\]

\[
D^2 r^2 = 2(a_1)^2
\]

\[
\frac{Dr}{a\sqrt{E}} = 1_a
\]

so that

\[
\frac{Dr}{a\sqrt{E}} = 1_a = h', \quad h' = \frac{Dr}{a} = D'
\]

\[
l_a = \frac{h}{\sqrt{E}} = \frac{1}{\sqrt{F}}, \quad Dr = a \not\rightarrow h = 1
\]

**Division by Zero**

Multiplication between the two sets of real numbers \( \{c, v, t, t'\}_x \) and \( \{c, v, t, t'\}_y \) in the initial or final state is defined by \( z(0) = (x_1, y_1) = xy(0) = yx(0) \) where the null vector represents an equal and opposite projection, so that \( z = xy = yx \).

Division is then represented by \( z(0) = \frac{yj}{x} = \frac{1}{x} \frac{j}{i} yj = \frac{y}{x} (i' j) \) so that \( (yj) = 0j \) means the dimension does not exist (there is no initial or final state), so that \( z(0) \) is undefined, where the symbol \( z = \bullet \) is an expression of this situation.

This is not equivalent to \( \frac{1}{g} \) and \( g \) being undefined for \( g_y = 0 \) however, since \( \frac{1}{g} = \sqrt{\frac{x^2}{y^2} - b^2} \) which results in \( \frac{1}{g} = 1 \) at \( b = 0, v = 0 \); that is, \( \frac{ct}{ct'} = \frac{ct'}{ct} = 1 \) so the initial and final states are equal.
That is, $g \rightarrow 0$ only if $c = c' \rightarrow 0$ at which point $c = 0$ and/or $t = t' \rightarrow 0$ and there is "nothing there"; no initial or final condition – the "universe" does not exist...
The Lorentz Transform and the Time Dilation equation

The equation Lorentz proposed as a characterization of the null results of the Michelson-Morley experiment was to assume the speed of light constant in determining Galilean distance:

\[(x = ct) \rightarrow (x' = ct')\]  \hspace{1cm} (1.2)

and proposing a change in the metric by scaling space and time to account for the null results:

\[a(x - vt) = (ct)(bt + gx)\]  \hspace{1cm} (1.3)

To solve this, the equations are squared so that

\[a^2(x - vt)^2 = (ct)^2(bt + gx)^2\]  \hspace{1cm} (1.4)

And then solved. The result is the Lorentz Transform of “space’’ and “time’’ characterized by the two equations:

\[x' = (x - vt)g\]  \hspace{1cm} (1.5)

\[t' = \frac{ct}{\sqrt{1 - \frac{v^2}{c^2}}} - \frac{vt}{c^2}g\]  \hspace{1cm} (1.6)

Multiplying the second equation by \(c\) results in

\[ct' = (ct)g - \frac{v(ct)}{c}g = (ct)g - (vt)g\]  \hspace{1cm} so that

\[x' = ct' = (x - vt)g\]  \hspace{1cm} (1.7)

which is the same as equation as the first. Then

\[ct' = (x - \frac{v}{c^2}ct)g = ctg \left(1 - \frac{v^2}{c^2}\right)\]  \hspace{1cm} so that

\[t' = tg \left(1 - \frac{v^2}{c^2}\right) = tg \left(1 - b\right)\]  \hspace{1cm} (1.8)

That is,

\[\frac{t'}{t} = g \left(1 - \frac{v^2}{c^2}\right) = g - bg\]

This is the “Time Dilation” equation \(\frac{t'}{t} = g\) only if \(bg = 0\); that is, there is no interactive scaling of \(g\) by \(b\), so that \(v = 0\), and the transform is now independent of momentum and is a characterization of energy only, where \(t' = tg, g = \frac{1}{\sqrt{1 - b^2}}, b^2 = \frac{mv^2}{mc^2}\).
Here all variables have been assumed to be a relation between “space-time” coordinates \( \{c,v,t,t'\} \) in which the space variable has been eliminated via (1.1) by effectively setting \( x' = x \) in the Lorentz equations (1.4) and (1.5). Note that the momentum in Newton’s laws is given by

\[
P = m\frac{v}{c}c = mv \quad \text{and} \quad E = m\frac{v^2}{c^2}c^2 = mv^2,
\]

where the momentum \( P \) in a Galilean coordinate system can be positive or negative depending on sense, but the energy \( E \) is always positive. Setting \( c = 1 \) recovers Newton’s laws.

The interpretation of the Lorentz transform was that the arms of the device had “contracted” to compensate for the null results of the experiment, but this was highly unsatisfactory, since no one could see a physical reason that should have happened.

From this perspective, Albert Einstein made the proposition that the equations of physics should not depend on the coordinate system, and therefore not on the “sense” of the momentum, which depends on an “origin” to distinguish between positive and negative momentum, which is consistent with the result of the Michelson-Morley experiment, which detected no change in the speed of light in all orientations.

He therefore proposed that the factor \( \frac{v}{c} \) be eliminated in equation (1.7). One way to do this would be by setting \( v = 0 \), thus eliminating momentum from the equation, but retaining the energy in

\[
g = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}} = \frac{1}{\sqrt{1 - \frac{mv^2}{c^2}}} \quad \text{for any arbitrary (Newtonian) mass, which results in the famous “time-dilation” equation:}
\]

\[
t' = t\sqrt{g}, \quad g = \frac{1}{\sqrt{1 - b^2}}, \quad b^2 = \frac{v^2}{c^2}, \quad b^2 > 0.
\]  

(1.9)

This conceptual approach is unsatisfactory because it removes momentum as a physical effect.

However, the other solution is to add the momentum as an additional energy, which requires abandoning (1.27 altogether as a physical model), thus rejecting the Lorentz transform altogether, and deriving (1.28) by solving \((ct)^2 = (v't')^2 + (ct)^2\) for \( t' \). Since the equation no longer refers to Galilean “space-time” coordinates (since there is no explicit origin to distinguish between “+” and “-”), but only to relationships a scaled relationship between \( v \) and \( c \) where solving (1.7) for \( v \) yields the result
\[ v = c \sqrt{1 - \frac{v^2}{c^2}} \]

, the equation can be converted to the “proper” field variables \( \{v, c, t, t'\}_a \) so that

\[ t' = t g, g = \frac{1}{\sqrt{1 - b^2}}, b^2 = \frac{\gamma v^2}{c^2} \]

, \( b^2 > 0 \) .

(1.10)

which is also the result of solving the equation \( (c t)^2 = (v t')^2 + (c t')^2 \) . Then the relativistic momentum is expressed in the Energy equation for Special Relativity as a function of positive mass, where \( m_0 = c t \), \( m' = m g \) and

\[ (E')^2 = (m' c^2)^2 = (P c)^2 + (E_o)^2 \]

So that \( \left( (m_0 g) c^2 \right)^2 = (P c)^2 + (m_0 c^2)^2 \) (i.e., \( \left( m' c^2 \right)^2 = (P c)^2 + (m_0 c^2)^2 \))

Where \( P = m_0 c (g b) = (m' g) v \) has the same form as Newton’s law except for \( g \)

Since the \( m_0 \) and \( c \) are non-negative in this equation, momentum is now considered an “equal and opposite” interaction effect, modeled by the null vector. For Einstein this was his concept of “simultaneity” in which he assumed the “signals” had no (electromagnetic) mass but still somehow interacted with an “observer”, so he interpreted this effect as gravity.

It is interesting that this idea contradicts the photo-electric effect (for which Einstein was awarded the Nobel prize in the sense:

\[ E = mc^2 = \hbar \frac{\hbar c}{\hbar} = \frac{\hbar}{t} \] so that \( E t = h \) where \( m = 0 \) implies that \( h = 0 \) or \( t = \bullet \)

This interpretation then depends as the “vacuum”, or “zero state” be the point of observation, in which the initial condition is that the Universe be completely empty. However, in real observation, the “vacuum” is really the temperature in the parking lot on the surface of the Earth, and the light with which we observe is largely from the sun. Therefore, as observers we are merely sensors – we “feel” gravity, and “observe” motion (the “Ow” and the “Wow” of physics) and subjectively the two are independent unless we get a sunburn.

At the time of Einstein, it was very difficult to measure any change of light on earth due to the orientation of the M-M apparatus, but the “slowing” of clocks is currently readily apparent in GPS satellites. However, this is not a Doppler effect (as with radar, which is a first order effect), but a relativistic second order effect; the same is true of Red Shift and Einstein rings. The effect derives from photo-electric “spin” polarization of mass equivalent photons (i.e. relativistic spin polarization).
(Of course, the first order effect derives from the second order effect, because of the Correspondence Principle in large scale interactions – for radar, the idea that light has no mass ignores antenna resistance at the source and sensor in linear signal processing and analysis).
The relativistic Lorentz Force

Let \( m' \equiv \frac{m}{\gamma} \) and \( b \equiv q \) so that \( \frac{b}{g} \equiv \frac{b}{m'} \gamma m_0 \), so that \( \frac{1}{q} \frac{b}{g} \equiv \frac{m_0}{m'} \gamma = g \)

\( B(y, z), E(y, z) \) where \( E(y, 0) \parallel B(0, z) \) and where \( B_j \) and \( Ek \) are orthogonal.

Let \( \frac{v}{c} = \frac{b}{c} = \frac{i}{c} = \frac{q}{c} \) and \( \frac{1}{g} \equiv \frac{1}{c} \equiv \frac{1}{l} \)

Then the vector space \((i, j, k, l)\) is characterized by \((b, B, E, \frac{1}{g})\) in the relativistic unit circle.

The Lorentz force is characterized by the equation

\[ F = q(E \otimes (v \mathcal{F}B)) \]

which can be restated relativistically as, so that

\[ F = A = q \frac{v}{E \otimes (\mathcal{F}B)} \]

\[ = \frac{m'}{m} \frac{1}{c} \]

\[ \frac{F}{m_0} = \frac{1}{g} \left( \mathcal{F}k \right) = A(\mathcal{F}k) = \frac{q}{m_0} \frac{1}{g} \mathcal{F}E \otimes (v \mathcal{F}B) \]

So that

\[ A(\mathcal{F}k) = \frac{q}{m_0} \frac{1}{g} \mathcal{F}E \otimes (v \mathcal{F}B) \frac{1}{3} k \]

Let \( m = k \mathcal{F}k \)

\[ Am = \frac{q}{m_0} \frac{1}{g} \mathcal{F}E \otimes (v \mathcal{F}B) \frac{1}{3} m \]

\[ A = q \frac{x}{m_0} \frac{1}{y} \mathcal{F}E \otimes (v \mathcal{F}B) \frac{1}{3} x \]

or equivalently by

\[ A = \frac{q}{m'} \mathcal{F}E \otimes q \mathcal{F}B \]

so that \( F = (m') (A) = q \mathcal{F}E \otimes q \mathcal{F}B \)

so that \( v = 0, q = b = 0, g = 1 \)
means that $F = (m_0)(A_m) = q \mathbb{k}E_k \times q_x B_y \frac{2}{3} = b_y q \mathbb{k}E_k \times b_x B_y \frac{2}{3} = 0$; i.e. $A_m = 0$ the Lorentz Force is
zero. For the initial condition \( m_0 = ct = 1 \) the result is \( F = m_0 \frac{q_x}{m_0} \approx q_x E_k \approx q_x B_y \frac{2}{3} \), so that
\[
F = A_m = \frac{q_x}{m_0} \approx q_x E_k \approx q_x B_y \frac{2}{3}.
\]
The “Vector Potential” \( A_m \) is then interpreted as the electromagnetic force per unit rest mass. For \( q_x = 1 \),
\[
F = A_m = q_x E_k \approx B_y \frac{2}{3}
\]
so that
\[
F^2 = A_m^2 = q_x E_k \approx B_y \frac{2}{3} = q_x (E_k)^2 \approx (B_y)^2 \frac{2}{3}
\]
and
\[
F = A_m = \sqrt{(E_k)^2} \approx (B_y)^2 \frac{2}{3} \quad \text{if} \quad (g_a E_a)^2 \approx (g_B B_a)^2 \frac{2}{3},
\]
where \( g_a = 1 \) and \( g_b = 1 \) in the independent relativistic sets \{c, v, t, \tau\}_a and \{c, v, t, \tau_\prime\}_b, where \( E_a \cdot \{a\} \) and \( B_b \cdot \{b\} \)

Then \( j^2 = (E + B)^2 = E^2 + B^2 + 2EB \) so that \( y^2 = E^2 + B^2 \approx E \cdot B = 0 \)
\[
E i \cdot B j = 0 \approx E_i \oint B j = EB, \quad EB \left| \oint j \right| = 2EB, \quad \text{so for} \ E > 0 \text{ and} \ B > 0 \ y \text{ cannot be valid,}
\]
and \( j^2 = (E + B)^2 = E^2 + B^2 + 2EB \) is an expression of the Binomial Expansion for \( n = 2 \)

The interaction term can be eliminated by \( j^2 = (E + iB)(E - iB) = E^2 + B^2 \)
CPT invariance

Charge $C = q = v$, Parity $P = c$, $m_0 = ct$ (invariant initial state), $m' = ct'$ (invariant final state)

$Pc = vc$ is always invariant for $b = \frac{v}{c}$ invariant ("inertial frame"). $t' = tg$ (mass) is invariant for $b$ invariant. Therefore

$ct$ is invariant for $t'$ (invariant final, observed state $ct'$ is invariant)

or

$ct'$ is invariant for $t$ (invariant initial, observed state $ct$ is invariant)

or

$ct = ct' \Rightarrow t = t'$ (Initial State = Final State) so $CPT = CPT'$, $T = T'$.
General Theory of Relativity

For \( n > 2 \), \( x^p y^{p-q} p^p y^{p-q} \), so that Planck’s constant must be applied separately for each particle where \( h_x h_y = h_x h_y \) even though \( h_x h_y = h_x h_y \) in the Binomial Expansion

\[
j'' = (h_x + h_y)^n = (h_x)^n + (h_y)^n + \text{rem}(h_x, h_y, n)
\]  

(1.11)

where \( \text{rem}(h_x, h_y, n) \) is analogous to the non-vanishing Christoffel (“acceleration”) symbols in the differential Geometry characterization of the General Theory.

If Gravity is assumed to be independent of Electromagnetism, then a new relativistic equation can be created with the final state of the Electromagnetic Field now assumed to be the initial state of the gravitational field, so that the Fundamental Equation of the Universe in the set of field variables \( \{c, v, t, u, v_g, u_g\} \) now becomes:

\[
(\text{ct})^2 = (v t_g)^2 + (\text{ct'})^2
\]

which has the solutions

1. \( t^g = t' g_g, g_g = \frac{1}{\sqrt{1 - b_g}}, b_g = \frac{v^g}{c}, v_r = \frac{v + v_g}{1 + \frac{vv_g}{c^2}} \)

2. \( l^2 = \frac{1}{b_g^2} + (b_g)^2 \) (Final State Solution)

3. \( (g_g)^2 = l^2 + (b_g g_g)^2 \) (Initial State Solution)

Gravitational Spin is then calculated from:

\[
j_g = \frac{1}{g_g^2} b_g^2 + \frac{1}{g_g^2} b_g^2 = \frac{1}{b_g^2} + (b_g)^2 + 2\frac{b_g b_g}{g_g^2} \text{ as above...}
\]
The Equation of the Universe

Initial State \( s_0 = c \tau \)

Final State \( s_\infty = c \tau' \)

Change of state = \( s_v = \tau' \)

\[
\begin{align*}
(c\tau')^2 &= (v\tau')^2 + (ct)^2 \\
(s_\infty)^2 &= (s_v)^2 + (s_0)^2 \\
(s_\infty)^2 &= (s_0)^2 \Rightarrow (s_v)^2 = 0 \\
(s_\infty)^2 - (s_v)^2 &= (s_0)^2
\end{align*}
\]

Therefore, \( s_v \) is the relativistic interaction between the final state and the initial state.

\[
\mathbf{\Phi} = (s_0)^2 + (s_\infty)^2 \quad \text{(The Equation of the Universe)}
\]

Interaction between initial State and Final state

\[
\mathbf{j} = (s_0 + s_\infty)^2 = (s_0)^2 + (s_\infty)^2 + 2(s_0)(s_\infty)
\]

Interaction only vanishes for

\[
\mathbf{\Phi} = (s_0)^2 + (s_\infty)^2 = \mathbf{\Phi}(s_0) + (is_\infty)^2 \mathbf{\Phi}(s_0) - (is_\infty)^2 = (s_0)^2 + (s_\infty)^2 + (s_0)(is_\infty) - (s_0)(is_\infty)
\]

If \( (s_\infty) = (ct') \) is the observed Universe, and \( Me = (ct) \) is the observer.

then the relativistic interaction between the initial and final states only vanishes if there is no god (i.e., an imaginary god is added and subtracted from my observation of a real universe.

\[
\mathbf{\Phi} = \left\{ \mathbf{\Phi}(Me)^2 + (s_\infty)^2 + (G_{ad})^2 \right\} - \left\{ \mathbf{\Phi}(Me)^2 + (s_\infty)^2 - (G_{ad})^2 \right\} = (Me)^2 + (s_\infty)^2
\]

The distinction between Me, god, and the Universe – (and possibly thee) is a conversation I am having with myself... \( \mathbf{j} \)
1/r² Physical Laws

The \( \mathbf{j}^2 = K \frac{xy}{r^2} = \frac{x_y K_y}{r^2} \) can be modelled as relativistic spin, with the \( xy \) representing interacting particles, \( K \) the coupling constant, and \( r \) the coefficient of the resultant vector between them, so that \( \mathbf{j}^2 r^2 = K \mathbf{r} = x_0 \left( K \mathbf{r} \right) \). The interaction term can then be interpreted as relativistic spin.

Examples are

- **New to n’s Law of Gravity**
- **Amper’e’s Law (TBD)**
- **Coulomb’s Law (TBD)**
- **Electromagnetic Force Law (TBD)**

**Newton’s Law of Gravity**

Let \( \sqrt{m_0} = g \) and \( \sqrt{Gm} = b \)

\[
\mathbf{j} \cdot \mathbf{r} = \left( \sqrt{m_0} \right)^2 i + \left( \sqrt{Gm} \right)^2 j = g i + b j
\]

\[
y^2 = g^2 + b^2 = \left( \sqrt{m_0} \right)^2 + \left( \sqrt{Gm} \right)^2 = m_0 + Gm
\]

\[
\mathbf{j}^2 = \left( g + b \right)^2 = \left( \sqrt{m_0} \right)^2 + \left( \sqrt{Gm} \right)^2 + 2Gm_0m
\]

\[
\mathbf{j} \cdot \mathbf{r} \cdot \mathbf{r} = \mathbf{j}^2 \left( r^* r \right) = m_0 \left( i \cdot i \right) + Gm \left( j \cdot j \right) + 2Gm_0m \left| \mathbf{j} \mathbf{r} \right|
\]

\[
\mathbf{f} \cdot r^2 \left( 0 \right) = m_0 \left( 0 \right) + Gm \left( 0 \right) + 2Gm_0m \left( 0 \right)
\]

\[
\mathbf{f} = \frac{1}{r^2} \left[ m_0 + Gm + 2Gm_0m \right]
\]

\[
s^2 = \frac{Gm_0m}{r^2} = \left( 2G \right) \frac{m_0m}{r^2} = G' \frac{m_0m}{r^2} \quad G' = 2G
\]

where the factor of 2 comes from the four quadrants of the relativistic unit circle.
For Kepler’s Law, replace \( m_0 \) and \( m \) by the axes of an ellipse... and then apply differential geometry to \( r \).

(a project for later if I can get to it...)
The Einstein/Bergmann derivation of the Lorentz Transform

08/02/2015

(Note: in this derivation, \( \gamma \) and \( \beta \) are reversed from the that in “The Relativistic Unit Circle; I probably got turned around somewhere along the way, but it is too late now... :)

I follow the derivation of the Lorentz Transform, following Peter S Bergmann in “Introduction to the Theory of Relativity” After an introductory explanation involving observers, trains, rods and clocks (in Cartesian coordinates), and with the assumption that the speed of light is a constant \( c \), and \( v \) defines “inertial motion” relative to \( c \), the actual analysis (pp. 38ff) begins with the hypothesis that the laws of physics are the same in every inertial frame. However, I interpret some of Bergmann’s characterizations a bit differently.

The constancy of the speed of light implies there is an absolute coordinate frame in which \( c \) is defined as

\[
x_c = ct_c \quad \text{and} \quad x'_c = ct'_c \quad \text{where} \quad c = \frac{x_c}{t_c} = \frac{x'_c}{t'_c}
\]

In this diagram, time moves up vertically, and the position coordinates of a photon modeled as a coordinate particle move right or left as the time axis crosses their red dotted “world lines”. Since the photons do not interact at the point (0,0) shown, they continue their straight world lines after they coincide. For a pure coordinate system, it is immaterial “when” the coordinate photons are created or destroyed as long as their world lines exist at their common point (at that point, they are “simultaneous”, at any other instant of time, they are separated.)
The velocity of light is then defined as \[ c = \left| \frac{x}{t} \right| \] since \( c \) is assumed to be isotropic (independent of direction) and homogeneous. If a medium is assumed, then the velocity of the medium is then assumed to be defined as \( v = \frac{x}{t} \) along some axis passing through the origin at which \( c \) is defined ...

A Michaelson-Morley apparatus consists of two orthogonal and equal arms which were rotated to test the effect of a motion \( v \) in some direction with respect to \( c \) in terms of an interference pattern, which would change along the arms as the system was rotated. Since no effect was observed, Lorentz hypothesized that the arms of the apparatus had actually changed to compensate for the interaction of the medium with the apparatus.

Lorentz assumed that the actual length of the arm in the direction of velocity would be changed by a factor linear \( \alpha \) that would vary as the system was rotated, causing a variation in space and time by interaction with the medium.

\[ x' = \alpha (x - vt), \quad y' = y = 0, \quad z' = z = 0 \text{(since } y \text{ is orthogonal to this axis, and } z \text{ is irrelevant)} \]

In particular, for \( v = 0 \) (an orientation orthogonal to the relative velocity of the medium), \( x' = \alpha x, \quad v = 0 \). For the orientation in line with the relative velocity of the medium, \( x = vt \), so that \( x' = 0 \), with \( \alpha \) to be determined. In the direction orthogonal to the position characterized by \( \alpha \) he then assumed that the measurement of time would be affected by a linear factor of both space and time, and replacing “\( y \)” with \( x' \):

\[ t' = \gamma x + \beta t \text{ so that} \]

\[ x' = \alpha t' = \alpha (\gamma x + \beta t) \]

Equating the two characterizations of \( x' \), we have the relation:

\[ \alpha (x - vt) = \alpha (\gamma x + \beta t) \]
Since these results apply to arms that are orthogonal, there are no interacting terms, and the apparatus is described by the lengths of the rotating arms in a medium where $c$ is homogeneous and isotropic, and the arm length change as the system is rotated:

The area of the circle can then be calculated by the relation:

$$p\alpha^2(x - vt)^2 = pc^2(gx - bt)^2$$

(Note: squaring both sides of the equation converts the model from a momentum (first order) to an energy (second order) representation.)

Eliminating $p$ and expanding and rearranging results in the expression:

$$(c^2b^2 - v^2\alpha^2)t^2 = (\alpha^2 - c^2g^2)x^2 + (\alpha^2 + c^2g^2)xt$$
Equating the coefficients of $x^2$ and $t^2$ ($c$ is a constant independent of area where $s_x = x^2 = xx$ and $s_t = t^2 = tt$), and setting the coefficient of $xt$ equal to 0 (no interaction between space and time – i.e., $x$ and $t$ are orthogonal) results in the expressions:

1: $c^2b^2 - v^2a^2 = c^2$
2: $a^2 - c^2g^2 = 1$
3: $va^2 + c^2bg = 0$

Equating $a^2$ from 1, 2:

1: $a^2 = \frac{c^2(1 - b^2)}{v^2}$
2: $a^2 = 1 + c^2g^2$

\[
\frac{c^2(1 - b^2)}{v^2} = 1 + c^2g^2
\]

4: $g^2 = 1 - \frac{c^2(1 - b^2)}{c^2 \frac{1}{4} v^2} = 1 - \frac{1}{3}$

Equating $a^2$ from (2, 3):

2: $a^2 = 1 + c^2g^2$
3: $a^2 = -\frac{c^2bg}{v}$

2, 3: $1 + c^2g^2 = -\frac{c^2bg}{v}$

From 1, 3

\[
\frac{c^2(1 - b^2)}{v^2} = -\frac{c^2b}{v} (g)
\]

5: $g = -\frac{(1 - b^2)}{vb}$

Squaring 5 and equating with 4:

\[
\frac{(1 - b^2)^2}{vb} = \frac{1}{c^2 \frac{1}{4} v^2} - \frac{1}{3}
\]
After a bit of algebra, this results in the expression:

\[
b^2 = \frac{1}{1 - \frac{v^2}{c^2}}
\]

Substituting in 5:

\[
g = \frac{1}{\nu b} (1 - b^2) = \frac{1}{\nu b}\frac{1}{\nu^2 b^2} = \frac{1}{\nu^2 b^2} (1 - \frac{1}{\nu^2 b^2})^2 = \frac{1}{\nu^2 b^2} (1 - \frac{1}{\nu^2 b^2})^2 = \frac{1}{\nu^2 b^2} (1 - \frac{1}{\nu^2 b^2})^2
\]

\[
1 - \frac{1}{\nu^2 b^2} = 1 - \frac{c^2}{c^2 - v^2} = \frac{c^2 - v^2 - c^2}{c^2 - v^2} = \frac{-v^2}{c^2 - v^2}
\]

\[
g = \frac{1}{\nu b} \frac{v^2}{v} \frac{v^2}{b} = \frac{1}{\nu b} \frac{(c + v)(c - v)}{(c + v)(c - v)} = \frac{v}{(c + v)(c - v)} = \frac{v}{\sqrt{c^2 - v^2}} = \frac{v}{\sqrt{c^2 - v^2}}
\]

That is, \( g = \frac{1 - b^2}{\nu b} = \frac{b v}{c^2} \)

Substituting in Equation 3:

\[
\]
These expressions for \( \alpha, \beta \) and \( \gamma \) are then substituted into the original equations:

\[
x' = \alpha (x - vt) = b(x - vt)
\]

\[
t' = \gamma x + \beta t = \frac{b}{c^2} x + b t = \frac{b}{c^2} \left( \frac{vx}{\sqrt{1 - \frac{v^2}{c^2}}} \right) + b t
\]

\[
b = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}}
\]

We have the Lorentz transforms (from Bergmann):

\[
x' = \frac{(x - vt)}{\sqrt{1 - \frac{v^2}{c^2}}}
\]

\[
t' = \frac{t - \frac{vx}{c^2}}{\sqrt{1 - \frac{v^2}{c^2}}}
\]

Again, in the rest of paper the roles of \( \gamma \) and \( \beta \) are reversed, so that I use:

\[
x' = (x - vt) \gamma
\]

\[
t' = \left( t - \frac{vx}{c^2} \right) \gamma
\]

where \( \gamma = \frac{1}{\sqrt{1 - b^2}}, \ b = \frac{v}{c} \)
Additional Papers I have written

The following are papers I have written in my journey, and will be drawing from to add to this work. Proceed with caution, as they are works in progress, and are in the process of being vetted and/or rewritten. When I have determined there is nothing more to be added from them here, I will remove them from this list, and occasionally adding others temporarily.

Previous version of this document

Updates to the Previous Version

Proof of Fermat’s Theorem (recent separate document)

Updates to the above document

The Creation of the Universe Part I (Almost Everything You Need To Know)

Relativistic Energy Derivation

The Pauli/Dirac matrices

Mathematics Foundation

Interpretation

Yet Another (Proof of Fermat's Theorem)

Relativity, the Binomial Theorem, and Pythagorean Triples

Axiom of Choice

Natural Logarithms

Proof of Fermat's Theorem using vectors

Proof of Fermat's Theorem using the Relativistic Circle

Spin Quantization
Vector Spaces

Summary

References

These are some of the texts I have read and often misunderstood during my intellectual journey:

Wikipedia

Math Is Fun (a surprisingly accessible site for the basics)

“Introduction to the Theory of Relativity”, Peter Gabriel Bergmann (forward by Albert Einstein)

“The Principle of Relativity”, Albert Einstein, Notes by A. Sommerfeld

“Classical Field Theory”, Davison E. Soper

“Introduction to Tensor Calculus, Relativity, and Cosmology”, D.F. Lawden

“Electrodynamics and Classical Theory of Fields and Particles”, A.O. Barut

“Tensor Analysis on Manifolds”, Richard L. Bishop and Samuel I. Goldberg

“Tensors, Differential Forms, and Variational Principles”, David Lovelock and Hanno Rund

“Quantum Field Theory”, Claude Itzykson and Jean-Bernard Zuber

“Introduction to Linear System Theory”, C.T. Chen

Many, many others during my tenure at Santa Barbara Research Center and General Resarch during the SDI period, before we all got laid off when peace broke out....

Application to Physics (TBD)

(Coming Soon)

Philosophy

The Derivative and the Initial Condition

(Eliminating nonlinearity up to the initial condition – (h (i.e., spin)->0)

The Vacuum and the “speed” of light

Zero Energy

Polynomials (many-bodies)

Normalization (Probability)

QM vs Field Theory

The Pauli/Dirac Matrices

The Electro-Magnetic Field Tensor

Minkowsky metric (homogeneous and inhomogeneous)