Overview of Mathematical Physics

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The Relativistic Unit Circle (Relativistic Spin, Fermat's Last Theorem)

Electron Spin (Classical Pauli and Spin Up/Down formulations)

Goldbach's Conjecture The issue of irreducible quanta (expressed as prime numbers in energy characterization)

The assumption in mathematical physics is those participating live on the planet earth in a real universe, where we observe most events in our life in terms of tangible objects. Central to our observation is that of light and our ability to view events, in which the speed of light is instantaneous for all practical purposes, and we experience events in the instantaneous "now", or immediate present. In the context of the senses, this is essentially the view of solipsism, which is inescapable as a "point in the stream of consciousness". Particularly relevant is not being able to remember being born, with memory of past events becoming more and more clear as one matures into adulthood into the present.

The relations between our senses suggest there is a real world defined by our ability to correlate and organize remembered events with those in the present, so as to infer cause and effect – and the ability to communicate with others that have a common language in which to describe the events constitutes the real world in which we exist.

Physics describes the relations between causes and effects in terms of a specialized language developed over the history of observers describing experimental results which permits prediction in which repeated experiments yield the same results, either directly or through sensors that reveal relations between elements in our experiments not amenable to direct perception (atoms, etc.).

For the most part these experiments are performed within the environment in which we live and communicate, taken to be the world at sea level. However, our experience also leads us to believe that we live on a small planet in a solar system that is infinitesimal compared with a much larger universe we experience with sensors (telescopes) in which the experiments on earth can be extrapolated in some sense to our understanding of that universe. Our experience also leads us to believe that we can understand and predict results from models inside the physical objects we feel.

In both cases, the relation of observed or felt structure to subjective light is fundamental in our interpretation of events.

Our experience with light (without which our other experiences cannot be interpreted) can be roughly divided into two categories; those which we see but do not feel with our other senses, and those which we feel (with or without light). Most of the light with which we observe events comes from the sun, but we don't feel light unless we get a sunburn.

Our understanding of physics (the "Tao" of physics) can be categorized by the "Wow" of physics (observations that we see) and the "Ow" of physics (observations that we feel); since (roughly speaking) these are independent of each other, the total of fundamental categories of our immediate experience can be counted as

$\text{“Tao”} = \text{“Wow”} + \text{“Ow”} = 2$, where the act of "counting" is that of differentiating between two invariant objects, thoughts, feelings, or perceptions. In the case of light, the "Wow" is the solipsistic expression of "just watching", and the "Ow" is when that watching results in the feeling of sunburn. If our perception of these objects are invariant they are said to be distinguishable, or "countable", and can be expressed as a pair $(a,b)=(b,a)$ in which the ordering is irrelevant, and the elements are said to **commute** under summation, so that $a+b=b+a$

The operation of summation, or **addition** allows the counting of otherwise invariant elements of our experience expressed as a single result. More "Wow" or "Ow" elements can be included in the "Tao" summation as required.

The relation between the "Tao", "Wow" and "Ow" elements of our experience can be expressed more generally (and concisely) by the expression

$\varphi_+ = a+b$, where the count is represented by $\sum(a+b)=2$, where each widget is assigned a unit value of one, so that $a=b=1$ for the purpose of counting. This is easily generalized to an arbitrary number of elements by using variables to express arbitrary structures (as "well formed formulae" within invariant elements in their "final states" , where the general term for independent elements such as a and b will now be called "widgets" . In the case of many widgets, the corresponding relations of summation of summation are codified by "association" and "distribution", which allows groups of widgets to be further categorized in hierarchies of "hyper-widgets", or "**groups**" of widgets.

It should be emphasized that φ is also a widget, with a count of 1 (also called a **"single valued function"** (of widgets).

The general expression for counting an arbitrary number of n widgets is given by the expression

$\sum_{i=1}^{n} x_i = n$ where $x_i = 1$ for the purpose of counting.

If there is an interaction between two widgets, it can be expressed by the operation of multiplication , where the product $\varphi = ab = ba$, where again the widgets commute. Multiplication between an arbitrary number of the same type of widget ("self-interaction") can be expressed as

$\prod_{j=1}^{m} a^i = a^m$, where m represents the number of widgets participating.

The interaction of two sets of widgets under self-interaction and addition can be expressed as

$$\varphi^2 = \left(a^n + b^m\right)^2 = \left(a^n\right)^2 + \left(b^m\right)^2 + 2\left(a^n\right)\left(b^m\right)$$

The case of $n = m = 2$ is fundamental to physics as expressing the forces between two particles (as widgets) where a and b are countable widgets, and the widget count is 2.

$$\sum_{i=1}^{2} x_i = 2 \;\; \varphi = a + b = 2 \text{ for } a = b = 1$$

In addition, countable widgets must be positive definite so that $a = \sqrt{a^2}$; that is, subtraction implies the disappearance of widgets. This means that if a widget is experienced and then vanishes, its existence is only remembered as memory, which is expressed by the imaginary number $\sqrt{-1}$, so that the reality of the widget is expressed by $a^2 + (ia)^2 = a^2 - a^2 = 0$ so that reality no longer includes the widget.

Then the expression for the self-interaction of the widget sum of a and b for $n = 2$

$$\varphi = a + b$$

Is given by

$\varphi^2 = \left(a + b\right)^2 = a^2 + b^2 + 2ab$ and in the most general case by the Binomial Expansion expressed as a result in terms of widgets, where $\varphi^n = \left(a + b\right)^n = a^n + b^n + rem(a,b,n)$ and $rem(a,b,n) > 0$, so the expression $\varphi^n = a^n + b^n$ is a well-formed formula (wff) that cannot be valid under the rules of widget summation and multiplication (interaction); since it is valid for all widgets, this constitutes a proof of Fermat's Last Theorem.

For the case of $n = 2$ the widget interaction can be imaginatively factored by a process called "conjugation", where for

$\psi = a + ib$ the self-interaction between the real widget and the imaginary widget can be factored out, so that $\psi\psi^* = \left(a + ib\right)\left(a - ib\right) = a^2 - \left(ib\right)^2 = a^2 + b^2$ where the imaginary quality of the b widget is indicated by the color magenta. Note that although $ab = ba$ commute multiplicative, the selection of a as real does not commute with the selection of b as imaginary. In reality, the expression is $\varphi^2 = a^2,\ b = 0$.

Note that Fermat's formula $\varphi^n = a^n + b^n$ is only valid for $b = rem(a,b,n) = 0$

Therefore, only the full expression $\varphi^n = (a+b)^n = a^n + b^n + rem(a,b,n)$ is countable, and can only be divided by the expression $(a+b)$ for φ^n to remain countable.

One Dimensional Widgets

The expression $\varphi^2 = (a+b)^2 = a^2 + b^2 + 2ab$ is an expression of interaction one dimension, indicated by the vector symbol $\vec{i}$, so that $\varphi^2\vec{i} = (a+b)^2\vec{i} = \left[a^2 + b^2 + 2ab\right]\vec{i}$ where the widgets are called **coefficients** of the vector $\vec{i}$ in that dimension.

The widgets $\varphi = c\tau'$, $a = c\tau$, and $b = v\tau'$ can be parameterized by the independent pair of widgets τ and τ' , so that all widgets $\{\varphi, (c\tau, v\tau')\}$ remains countable in the dimension, where multiplication between widgets is characterized by the "outer product", or "dot product" $(\cdot)$ in two dimensions where $1(\vec{i}) = 1,\ (\vec{i}\cdot\vec{i}) = 1^2$ and 1 represents the scalar coefficient of the unit vector $\vec{i}$ which is called the **basis** of the dimension. Then

$$(c\tau')^2(\vec{i}\cdot\vec{i}) = \left[(c\tau)^2 + (v\tau')^2 + 2(c\tau)(v\tau')\right](\vec{i}\cdot\vec{i}) = \left[(c\tau)^2 + (v\tau')^2\right]\vec{i} + \left[2(c\tau)(v\tau')\right](\vec{i}\cdot\vec{i})$$

yields the coefficient result

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

which consists of the self-interacting pair of widgets $\left[(c\tau)^2, (v\tau')^2\right]$ which do not interact in the sum $\left[(c\tau)^2 + (v\tau')^2\right]$ and the interacting pair of widgets $\left[(c\tau),(v\tau')\right]$ in the interaction product $\left[2(c\tau)(v\tau')\right]$

The expression $(c\tau')^2 = \left[(c\tau)^2 + (v\tau')^2\right] + [2(c\tau)(v\tau')]$ is the fundamental expression of two-widget interaction in a single dimension.

Final and Initial States of the system φ

Consider the system

$$\varphi\vec{i} = (c\tau)\vec{i} + (v\tau')\vec{i} = \left[(c\tau) + (v\tau')\right](v\tau')]\vec{i}$$

So that

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

Note that $(\tau')^2$ is a scaling factor on $(c)^2$, so that the result can be characterized as a change on $(c)^2$ unless $\tau'=1=\tau, v=0$

Basis as Initial State

If each side of the equation is divided by $c\tau$, the expression becomes

$$\left(\frac{\tau'}{\tau}\right)^2=(1)^2+\left(\frac{v}{c}\frac{\tau'}{\tau}\right)^2+2(1)\left(\frac{v}{c}\frac{\tau'}{\tau}\right)$$

Setting $\gamma\triangleq\frac{\tau'}{\tau}$ and $\beta\triangleq\frac{v}{c}$ results in the expression

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

Note that the expression $(\beta\gamma)^2+2\beta\gamma$ can be considered a "change" to the unit vector, since $v=0=\beta$ so that $\tau'=\tau$ results in $(\gamma)^2=(1)^2$ where the condition of change is $(\gamma^2)>1^2$ so that $\left(\frac{\tau'}{\tau}\right)^2>1^2$

In this sense, the condition $\tau'=\tau$ represents an initial state of the system characterized by $v=0=\beta$ which is "perturbed" or changed by β to grow larger (in physics, the condition of "absorption")

Basis as Final State

If each side of the equation is divided by $c\tau'$, the expression becomes

$$1^2=\left(\frac{\tau}{\tau'}\right)^2+\left(\frac{v}{c}\right)^2+2\left(\frac{\tau}{\tau'}\right)\left(\frac{v}{c}\right)$$, so that $$1^2=\left(\frac{1}{\gamma}\right)^2+(\beta)^2+2\frac{\beta}{\gamma}$$

In this case, the interaction product reduces the effect of the factors on the right-hand side, since $v<c$ $0<\beta^2<1^2$ results in $\frac{\tau}{\tau'}<1$ so that $\frac{1}{\gamma}<1$

Newton's Definition of Momentum and Energy

Note that Newtons definition of momentum can be characterized as

$P = (m\beta)c = mc(\beta) = m\left(\frac{v}{c}\right)c = mv$ and energy as $E = (\beta)^2 c^2 = m\left(\frac{v^2}{c^2}\right)c^2 = mv^2$ for any value of the widgets v and c defined by the relation $\beta = \frac{v}{c}$. There is no initial or final state for $v = 0$ γ is not a factor in the equations.

The Theory of Relativity (Widget Version)

In order to include Maxwell's result of $c^2 = \frac{1}{\varepsilon_0 \mu_0}$ interpreted as the "speed" of light by linearizing Ampere's and Coulomb's laws via Stoke's theorems, Einstein proposed the c be a constant; so that by setting $c = 1$ it could be factored into

$\beta = \left(\frac{\varepsilon_0 \mu_0}{\varepsilon_0 \mu_0}\right)\left(\frac{v}{c}\right) = \frac{v}{c}$ and thus ignore Newton's laws altogether by considering mass as a function of c , so that $m_0 = c\tau$ and $(m_0)^2 = (c\tau)^2$ in terms of the final state, where c is considered the rate of mass creation, and $m_0 = c\int_0^{\tau_0} (\tau) d\tau = c\tau_0$

The Photo-Electric effect (deBroglie wavelength).

In order to account for the photo-electric effect, Einstein defined the photon-equivalent energy of a single widget to be

$E = h\nu = \frac{hc}{\lambda} = \frac{hc}{c\tau} = \frac{h}{\tau}$ In order for h to be invariant, then in the expression $E\tau = h$ must be a constant, and therefore E and τ must be inversely proportional, or "contravariant), where $E = h$ for $\tau = \tau' = 1$.

Setting $E_0 = m_0 c^2 = \frac{hc}{\lambda}$ yields the deBroglie wavelength $\lambda = \frac{h}{m_0 c}$ and $\lambda' = \frac{h}{m'c} = \frac{h}{(m_0 \gamma) c} = \frac{\left(h/\gamma\right)}{m_0 c}$, where the last term suggests that h varies with $\frac{1}{\gamma}$ instead of the rest mass with γ .

Note that for $\tau = \tau' = 1$, $E_0 = h$, $E_n = nE_0 = nh\nu$, and for $\nu = 1$, $E_n = nh$ where E_n is no longer dependent on frequency.

Newton's Laws and Maxwell's Equations

In order to conform with Newton's laws, expressed in terms of $\beta = \frac{v}{c}$ for $c = 1$, the initial state must be expressed as $c\tau = 1$.

However, to conform with Maxwell's equations, this expression must be invariant for any value of v, so the interaction factor $2(c\tau)(v\tau')$ has to be eliminated from the full expression

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

This is accomplished in Special Relativity by conjugation, where

$\varphi' = c\tau + iv\tau'$ so that

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

Solving $(c\tau')^2 = (c\tau)^2 + (v\tau')^2$ for τ' results in the so-called "time dilation" equation

$\tau' = \tau\gamma_L$, where $\gamma_L = \frac{1}{\sqrt{1-\beta^2}}$, $\beta^2 = \frac{v^2}{c^2}$. Note that β^2 is equivalent to a Newtonian expression for energy in terms of any arbitrary mass m, where $\beta^2 = \frac{mv^2}{mc^2}$.

It is important to recognize that $\varphi' \pm \varphi$ in the full expression since $\gamma_L \neq \gamma$; by a misuse of language, γ_L is called the "Lorentz" factor, and linear equations using γ_L are called "Lorentz transformations".

Conclusion

By eliminating the interactions $2\frac{\beta}{\gamma}$ and $2\beta\gamma$ the result of the full equation is altered to the form

$1^2 = \left(\frac{1}{\gamma}\right)^2 + (\beta)^2 = \cos^2\theta + \sin^2\theta$, recoupin the linear analysis of Maxwell for a constant c, and ensuring that the $\varepsilon_0 E$ and $\mu_0 B$ fields remain orthogonal for $\varphi = (\varepsilon_0 E) + (\mu_0 B)$

in the relation

$\varphi^2 = (\varepsilon_0 E)^2 + (\mu_0 B)^2 + 2(\varepsilon_0 E)(\mu_0 B) = (\varepsilon_0 E)^2 + (\mu_0 B)^2 + 2\varepsilon_0\mu_0(E)(B)$

So that $\varphi^2 =$ $\varphi^2 = (\varepsilon_0 E)^2 + (\mu_0 B)^2 + \left(\frac{1}{c^2}\right)2(E)(B)$ where there is no interaction between the Fields for $\varphi' = (\varepsilon_0 E) + i(\mu_0 B)$ so that

$(\varphi')(\varphi')^* = [(\varepsilon_0 E) + i(\mu_0 B)][(\varepsilon_0 E) - i(\mu_0 B)] = \left[(\varepsilon_0 E)^2 + (\mu_0 B)^2\right]$

Satisfying Poynting's vector for $\varepsilon_0 = \mu_0 = 1^2$

Note that for $E = B = 1$, $(\varphi')(\varphi')^* = 1^2 = E^2\cos^2\theta + B^2\sin^2\theta$ for all values of θ, so that time can be reintroduces as $1^2 = E^2\cos^2(\theta t) + B^2\sin^2(\theta t)$ for all values of t, where

$1 = \cos(\theta t) + i\sin(\theta t)$ and

$1(1)^* = [\cos(\theta t) + i\sin(\theta t)][\cos(\theta t) - i\sin(\theta t)] = \cos^2(\theta t) + \sin^2(\theta t)$ for all values of θ and t

Note that $1(1)^* = (1)^*((1)^*)$ but that $\sin(\theta t)$ and $\cos(\theta t)$ are not interchangeable, and so therefore are uncountable.

Degeneracy and Quantum Mechanics

In physics, the approximation is sometimes made in which the interaction is ignored by simply declaring

$(c\tau')^2 = (c\tau)^2 + (v\tau')^2 + 2(c\tau)(v\tau') = \Phi^2 = (C\mathrm{T})^2 + (V\mathrm{T}')^2$ so that

$\Phi^2 = (C\mathrm{T})^2 + (V\mathrm{T}')^2$ is linear, and can be normalized as a "Unit Circle" where the interaction $2(c\tau)(v\tau')$ is subsumed in Φ^2.

This is the approach of Classical Quantum Mechanics in which Planck's constant is included in the Schrodinger wave equation only to be factored out when the derivative is taken to retrieve the Probability from the Probability amplitudes.

Relativistic Quantum Field Theory

This, of course, is an approximation in terms of the interaction, and is the heart of Einstein's complaint that Quantum Mechanics is not "complete" and Feynmann's discomfort with re-normalization in Quantum Field theory where the Green's function is represented as

$\phi = \dfrac{1}{\sqrt{(Pc)^2 + (E_0)^2 + i\varepsilon}}$ where $i\varepsilon$ is an infinitesimal, representing the fact that $(\gamma\beta)^2$ approaches $(\gamma)^2$ as $v \to \theta$, and the steps between each quantum increment $\Delta i\varepsilon$ become smaller and smaller as particle count or continuous field increases and the initial state $\left(\dfrac{c\tau}{c\tau}\right)^2 = (1_{c\tau})^2$ shrinks in comparison to to the final state $\left(\dfrac{c\tau'}{c\tau'}\right)^2 = (1_{c\tau'})^2$ where $\left(\dfrac{\tau'}{\tau'}\right)^2 > (1)^2$ but as long as change exists $v \neq 0$, renormalizaton is impossible.

The issue of irreducible quanta (expressed as prime numbers in energies) is addressed in my proof of Goldbach's Conjecture.

The bogus relation of Theory of Special Relativity to "Space-Time"

By declaring c to be a universal constant, Einstein avoided all relation to the coordinate analysis used by Maxwell in terms of Stokes' and Green's theorems, and declared his theory to be that of "Inertial" frames analagous to Newton's Laws of motion in terms of v and c alone , rather than "coordinate transformations involving "space" and "time". The relation becomes clear by deconstructing

$\beta = \frac{v}{c} = \frac{x_v}{t_c}\frac{t_c}{x_c}$ where the deconstruction in terms of $\{x_c, t_c, x_v, t_v\}$ with $v = \frac{x_v}{t_v}$ and $c = \frac{x_c}{t_c}$

orthogonal by setting either $x_v = x_c$ or $t_v = t_c$

In either case, γ_L can then be interpreted as a coordinate light "density" meaning that for $v < c$ if one holds $t_v = t_c$ one travels a shorter distance then if $v = c$, and if one holds $x_v = x_c$ one covers the same distance faster if $v = c$. In both cases, where

$(c\tau') = (c\tau)\gamma_L \Leftrightarrow \tau' = \tau\gamma_L$, γ_L must be considered a "light" density in terms of mass, since $x' = (c\tau') = m'$ increases with $v > 0$ which would not be the case if x' referred to distance.

(Note – in General Relativity Einstein introduces the concept of curved coordinates to represent gravity in his model of the metric in order to distinguish it from Special Relativity. However, each dimension is complete under the real number system, and the dimensions cannot interact, so the metric tensor remains as the identity matrix, in either the initial or final states as above.

However, in the context of that which we can actually observe as human beings on earth where are instruments must ultimately reflect our local environment in which c is a constant and unobservable as a velocity in "spacetime", he is correct.

The flaw is the model of differential geometry is that light can't be curved and flat at the same time, and the interactions modeled by the Binomial and Multinomial theorems must be taken into account fro a "complete" non-linear theory n which waves are degenerate descriptions of the real world.

This is only true for the LaGrangian (particle) characterization of physical interactions as opposed to the Eulerian (streamline) mode. By modeling geodesics as streamlines, Einstein hoped to use Riemannian geometry to model gravity, which works for continuous functions, but not for particles.

The "wave-particle" duality rears its head in GTR as well as QM…

The full analysis of the complete interaction characterization is discussed in my document

The Relativistic Unit Circle , where the relativistic Dirac spin is interpreted as the interaction relation $2(c\tau)(v\tau')$.