Mathematical Physics

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11/14, 11/15

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To be done

(coordinates, etc.)

Positive definity ☺

Number Line

Origin

Length

Space-Time as vector in STR (TBD)

Position from single origin (TBD)

$(0,0)$
(x,t)

Completeness of mathematical opera

Degeneracy (experimental)

Scaling (why radiation STR "almost" works for everyday (experimental reality).

Locomotive/cave thought experiment

Fermat's Last Theorem

Let c,a,b,n positive numbers (not necessarily integers)

$$c = a + b$$
$$c^n = (a+b)^n = a^n + b^n + \operatorname{Re} m(a,b,n) \quad \text{(Binomial Theorem)}$$
$$c^n = a^n + b^n \Leftrightarrow \operatorname{Re} m(a,b,n) = 0$$
$$\operatorname{Re} m(a,b,n) \neq 0$$
$$c^n \neq (a+b)^n \quad \text{QED}$$

True also for $n = 2$

$$c^2 = (a+b)^2 = a^2 + b^2 + 2ab$$

Note: Wiles' proof depends on modular functions defined on the upper half of the complex plane. My proof does not use complex numbers where

$$i^2 = \left(\sqrt{-1}\right)\left(\sqrt{-1}\right) = \sqrt{(-1)(-1)} = \sqrt{(1)(1)} = \sqrt{1^2} = 1,\; i = \sqrt{1}$$

(i.e., there is no complex plane; it is a figment of the imagination)

Prime Numbers

For any number a:

$$1_a \triangleq \frac{a}{a},\ 1_b = 1_a \Leftrightarrow b = a,\ 1_a = \log_{1_a}\left(1_a\right)$$

$\left\{1_a\right\} = \left\{o_a\right\}$ is a prime number, so $\left(1_a\right)^2$ is also a prime number.

$2\left(1_a\right)^2 = \left(1_a\right)^2 + \left(1_a\right)^2 \equiv \left\{e_a\right\}$ (Goldbach's Theorem, since a can be any number whatever, so every even number is the sum of two primes.)

$$\left\{I_a\right\}^2 = \left(1_a\right)^2 + 2\left(1_a\right)^2 = \left\{o_a\right\} + \left\{e_a\right\}$$

Goldbach's Conjecture (now Theorem)

p and $\left[\left(1_o\right) \triangleq \frac{n}{n}\right]$ are prime numbers for any numbers $\left(p, n\right)$

$$\left[\left(p\right) + \left(1_o\right)\right]\left[\left(p\right) - \left(1_o\right)\right] = 2p\left(1_o\right) = 2p\left(1_o\right)$$

$$\psi \triangleq \left[\left(p_1\right) + \left(p_2\right)\right]$$
$$\psi^* \triangleq \left[\left(p_1\right) - \left(p_2\right)\right]$$
$$\psi\psi^* = \left[\left(p_1\right) + \left(p_2\right)\right]\left[\left(p_1\right) - \left(p_2\right)\right] = \left(p_1\right)^2 + \left(p_2\right)^2 = 2\left(p_1 p_2\right)$$

$$30 = 2\left(3\right)\left(5\right) = \left(\sqrt{23}\right)^2 + \left(\sqrt{7}\right)^2 = 23 + 7$$
$$30 = \left(\sqrt{25}\right)^2 + \left(\sqrt{5}\right)^2 = 25 + 5$$
$$30 = \left(\sqrt{29}\right)^2 + \left(\sqrt{1}\right)^2 = 29 + 1$$

$$n = p + q$$
$$n^* = p - q$$
$$nn^* = \left(p + q\right)\left(p - q\right) = p^2 + q^2$$

p,q prime iff $p^2+q^2=2pq$

$$p^2+q^2=2pq$$
$$11^2+7^2=2(7)(11)$$
$$121+49=170\neq 154$$
$$170=(2)85=(2)(17)(5)=2pq$$

$$170+54=324$$
$$\sqrt{324}=18=(17+1)$$
$$(17+1)^2=17^2+1^2+2(17)(1)$$
$$(18)^2=289+1^2+34=290+34=324$$

Non-Interacting elements (Prime Numbers)

Two odd (non-interacting, prime) numbers are represented by the matrix

$\left|I_{a,b}\right|^n \triangleq \begin{vmatrix} 1_a & 0 \\ 0 & 1_b \end{vmatrix}^n = \begin{vmatrix} (1_a)^n, & 0 \\ 0 & (1_b)^n \end{vmatrix}$, $Tr\left|I_{a,b}\right|^n=(1_a)^n+(1_b)^n$ However, the $Det\left|I_{a,b}\right|^n=0$ since a and b are scalar components of affine (not interacting) vectors $\vec{a}=\begin{vmatrix} 1_a \\ 0 \end{vmatrix}, \vec{b}=\begin{vmatrix} 0 \\ 1_b \end{vmatrix}$. That is, the scalar product ab is not defined.

Interacting Elements (Even numbers)

Interaction of two elements is defined as the relation:

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

This relation is also consistent for $a=ct$ and $b=vt'$

Here $2(ct)(vt')=2ab$ is the interaction term, where the perturbation term $b=v\tau'$ is modified by the inverse of the coordinate distance $\frac{1}{x_d}$ for physics, so that

$$\varphi(x_d) = x_0 + \left(\frac{x'}{x_d}\right),\ x_0 = c\tau_0,\ x' = v\tau'$$

$$\varphi^2(x_d) = x_0^{\ 2} + \left(\frac{x'}{x_d}\right)^2 + x_0\left(\frac{2x'}{x_d}\right)$$

In radial coordinates:

$$\varphi(r_d) = r_0 + \left(\frac{r'}{r_d}\right)$$

$$\pi\varphi^2(r_d) = \pi r_0^{\ 2} + \pi\left(\frac{r'}{r_d}\right)^2 + r_0\left[2\pi\left(\frac{r'}{r_d}\right)\right],\ r_0\left[\left(\frac{2\pi r'}{r_d}\right)\right] = r_0\left[\frac{C_{r'}}{r_d}\right]$$

Parameterization of length in terms of time

$$x = vt$$

$$\frac{x}{t} \triangleq v$$

$$\frac{x}{t} \triangleq v\left(\frac{t}{t}\right) = v\left(1_t\right),\ 1_t \triangleq \frac{t}{t}$$

$$\frac{\Delta x}{\Delta t} \triangleq v\left(\frac{\Delta t}{\Delta t}\right) = v\left(1_{\Delta t}\right),\ 1_{\Delta t} \triangleq \frac{\Delta t}{\Delta t}$$

$$\frac{dx}{dt} \triangleq v\left(\frac{dt}{dt}\right) = v\left(1_{dt}\right),\ 1_{dt} \triangleq \frac{dt}{dt}$$

Note that this defines multiplication. For example, in the discussion below the expression $x = c\tau$ can be used to represent many contexts, e.g.
$F = ma,\ m_0 = ct, E = h\nu, P = mv, \lambda_{c\tau_c} = c\tau_c, \lambda_{v\tau_v} = v\tau_v, \lambda_{(c\tau_c)}' = \left(c\tau_c\right)'$, etc.

Impulse Response

The Impulse Response of an Inertial System is given by

$$x_{vt} \triangleq vt$$

$$x_{vt} \triangleq S_{vt} = S_v t$$

$$\frac{S_{vt}}{t} = S_v\left(\frac{t}{t}\right) = S_v\left(1_t\right)$$

S_v is an inertial system defined by velocity, $1_t \triangleq \frac{t}{t}$ is a unit impulse to the base t and $\frac{S_{vt}}{t}$ is the system response.

Complex Numbers

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

$$\psi = a+ib$$
$$\psi\psi^* = a^2+b^2=(a+ib)(a-ib)=a2+i(ba)-i(ab)+b^2$$

$|ab|=|a\otimes b|=\frac{1}{2}(2|ab|)$, so that the cross product $+|(ab)|=-|(ba)|$ is half the interaction term with the sign defined by the order of the elements.

$$\varphi = a+b$$
$$\varphi^2=a^2+b^2+2ab=a^2+b^2+h^2$$

$h^2 \triangleq 2(ab) \triangleq 2\left(\sqrt{ab}\right)^2 \triangleq 2S^2,\ S \triangleq \sqrt{ab}$, where

This means that i is just a tag on the interacting elements that indicates the interaction term $2ab$ is eliminated in the expression

$$\psi = a+ib$$
$$\psi\psi^* = a^2+\left(i^2\right)b^2=a^2+(1)b^2$$

but is mathematically insignificant. Example:

$$\psi = 3+4i$$
$$\psi\psi^* = (3+4i)(3-4i)=9+16=25$$
$$\psi\psi^* = (3+4)(3-4)=9+16=25$$

I prefer to color "imaginary numbers" so that the color indicates that it is the binary expansion $\varphi^2=a^2+b^2+2ab$ for $n=2$ with the interaction term removed by conjugation:

$$\psi \triangleq (3+4i)\equiv(3+4)$$
$$\psi\psi^* \triangleq (3+4)(3-4)=3^2+4^2=16$$

$$c = a + b$$
$$c^2 = a^2 + b^2 + 2ab$$
$$\psi \triangleq a + b$$
$$\psi^* \triangleq a - b$$
$$\psi\psi^* = (a+b)(a-b) = a^2 + b^2 = a^2(+ab - ba) + b^2$$
$$ab - ba \equiv a \otimes b + b \otimes a$$
$$c^2 = a^2 + b^2 + (a \otimes b + b \otimes a) + 2ab$$

Conjugation 11/15

Note that

$$\psi \triangleq c\tau + v\tau'$$
$$\psi^* \triangleq c\tau - v\tau'$$

$$\psi + \psi^* = 2c\tau$$
$$\psi - \psi^* = 2v\tau'$$

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

Conjugation eliminates the cross product as well as the interaction term, but in first order only expresses the initial state $2(c\tau)$ and the perturbation $2(v\tau')$ (under addition/creation) but not both.

It therefore cannot express the final state $(c\tau')^2$ in second order of interacting particles, where:

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

Special Relativity

Derivation from the Lorentz transform

The Lorentz transformation are two equations relating space and time derived via Lorentz' solution of squaring the equation $\alpha(x - vt) = c(\Gamma x + \beta t)$ to account for the null results of the Michelson-Morley experiment by equating coefficients, and choosing a solution of the result. (Note that the term on the left is a subtraction, and that on the right is an addition, suggesting that the solution chosen is one term of a conjugation.)

The resulting transform are the two equations

$$\Gamma = \frac{1}{\sqrt{1-\beta^2}},\ \beta = \frac{v}{c}$$
$$x' = (x - vt)\Gamma$$
$$t' = (t - \frac{vx}{c^2})\Gamma$$

To see how the “Time Dilation “ is derived from this expression, first declare c a constant velocity (for sea level, suggested by Maxwell’s (vector) derivation of the “speed” of light, resulting in $c = \frac{1}{\sqrt{\varepsilon_0 \mu_0}}$ where ε_0 and μ_0 are the “permittivity” and “permeability” constants derived from Coulomb and Ampere’s experimental force laws. This results in the axiom

$$x = ct \Leftrightarrow x' = ct'$$

Substituting $x' = ct'$ into the second equation results in

$$ct' = (ct - \frac{vx}{c})\Gamma = (ct - \beta x)\Gamma,\ \beta = \frac{v}{c}$$

Setting $x = ct$ results in

$ct' = (ct - \frac{vx}{c})\Gamma = (ct - vt)\Gamma = (x - vt)\Gamma,\ x = ct$ where $ct' = x' = (x - vt)\Gamma$ is identical to the first equation. Eliminating the “distance” term ($\chi = vt = 0$) results in the equation

$t' = t\Gamma = \frac{t}{\sqrt{1-\beta^2}}$ where $\frac{\tau'}{t} = \Gamma \geq 1$

The “time dilation” equation $\tau' = \frac{\tau}{\sqrt{1-\beta^2}}, \beta = \frac{v}{c}$ of Special Relativity can be derived from the expression $(c\tau')^2 = (c\tau)^2 + (v\tau')^2$ which can only be derived by conjugation:

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

Where $\psi\psi^* = (c\tau')^2 \Rightarrow (c\tau')^2 = (c\tau)^2 \Leftrightarrow (v\tau')^2 = 0$

That means that $(c\tau)^2$ and $(v\tau')^2$ do not interact (are “affine”, $\perp$), (and so are represented by prime numbers) in the matrix $|R|^2 \triangleq \begin{vmatrix} c\tau & 0 \\ 0 & v\tau' \end{vmatrix}^2 = \begin{vmatrix} (c\tau)^2 & 0 \\ 0 & (v\tau')^2 \end{vmatrix}$, where $Tr|R|^2 = (c\tau)^2 + (v\tau')^2$, but $Det|R|^2 = 0$ because the product $(c\tau)\,(v\tau')$ has been eliminated by conjugation.

(This implies that there is no energy penalty for rotation of the unit vector in the RUC, since there is no change in entropy $2\sin\theta\cos\theta = 0$ under rotation.)

Since h^2 is the interaction energy in the general expression, the relation

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

, where $n\left[2(c\tau)(v\tau')\right]$ is the interaction energy term for n interacting particles

and $nE_{\text{int}} = nh^2$.

The final state (radiation) is given by dividing by $(c\tau')^2$:

$(1_{c\tau'})^2 = \left(\frac{1}{\gamma}\right)^2 + \beta^2 + 2\left(\frac{\beta}{\gamma}\right) = \cos^2\theta + \sin^2\theta + 2\sin\theta\cos\theta,\ \gamma \triangleq \frac{\tau'}{\tau},\ \beta \triangleq \frac{v}{c}$ For $\theta = 0$, $\beta = 0$, and the expression becomes $(1_{c\tau'})^2 = \cos^2(0) = (c\tau)^2$ where $v = 0$ at the end of the interaction. At that point, the initial state has been diminished by the scaling of the interaction term $2\sin\theta\cos\theta$, but when $v = 0$ there is no further perturbation and a new initial state $(1_{c\tau'})_{v=0} = (1_{c\tau'})'$ is obtained

, so that $(1_{c\tau'})' = (c\tau)'$ this invariant final (initial) state can then be perturbed $(v'\tau'')$ so that

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

(Note that a $\frac{1}{x^2}$ term provides a scaling of the interaction term with distance (see my analysis of the Lorentz force) so the interaction dies off with distance for $x > 1$ which would be the signal as received by a sensor, with the interaction term the radiated particle. This provides the coordinate relation for the expression in two dimensions.)

(for the radial expression, multiply the 2nd order expressions by π where

$$\pi(c\tau')^2 = \pi(c\tau)^2 + \pi(v\tau')^2 + (c\tau)2\pi(v\tau')$$
$$r = (c\tau), r' = (v\tau'),\ h^2 = rC_{r'}$$
$$r' = \frac{s}{\theta} \Rightarrow h^2 = rC_{\left(\frac{s}{\theta}\right)}$$

So that the interaction $h_{r'}{}^2 = r(2\pi r') = r(\frac{s}{\theta})$ can be represented as an arc length in the RUC, where $C_{r'} = \frac{s}{\theta}$. Then the "distance" reduces the interaction term by the "radius" r_x in the single dimensioni by $\left(\frac{1}{(r_x)^2}\right)(h_{r'})^2 = \left(\frac{1}{(r_x)^2}\right)[r(2\pi r')] = \left(\frac{1}{(r_x)^2}\right)\left[r(\frac{s}{\theta})\right]$ (i.e., x is "line of sight"; a flat "geodesic", with curvature given by $(h_{r'})^2 = \left[r(\frac{s}{\theta})\right]$ in the RUC)

If the source $(c\tau)^2$ $(c\tau')^2 \le (c\tau)^2$

$(v\tau')^2$ disturbing the path between (the "red shift") reduction due to

$h^2 = 2\left(\frac{\beta}{\gamma}\right) = 2\frac{v\tau'}{c\tau}$ If there has been no change during the path, then $\left(c\tau'\right)^2 = \left(c\tau\right)^2$, $\tau' = \tau$ and there has been no change (nothing in the path) (Feinstein's "path integrals" are the probabilistic changes along all possible paths – if there is "nothing there" then the "probability" of identical particles over the path is unity. Note, however, that the concept of integration includes the "integration constant", which is analogous to the REMainder of the Multinomial expansion.

Note that this only applies to ("trigonometric") radiation, but not to ("hyperbolic") absorption in the full analysis of the RUC.

"Relativistic" Addition of Velocities

The equation for "relativistic" addition of velocities is given by:

$$w = \frac{u \pm v}{1 \pm \frac{uv}{c^2}}$$

The Lorentz transforms are:

$$x' = (x \pm vt)\Gamma$$

$$t' = (t \pm \frac{vx}{c^2})\Gamma$$

The resulting velocity w is then defined in the primed frame as:

$$w = \frac{x'}{t'} = \frac{(x \pm vt)}{(t \pm \frac{vx}{c^2})}(1_\Gamma),\ 1_\Gamma \triangleq \frac{\Gamma}{\Gamma}.$$

$$x = ut,\ t = \frac{x}{u}$$

$$w = \frac{x'}{t'}(1_\Gamma) = \frac{(ut \pm vt)}{(\frac{x}{u} \pm \frac{vx}{c^2})}(1_\Gamma) = \frac{(u \pm v)t}{x\left(\frac{1}{u} \pm \frac{v}{c^2}\right)}(1_\Gamma) = \frac{(u \pm v)t}{x\frac{1}{u}\left(1 \pm \frac{uv}{c^2}\right)}(1_\Gamma) = \frac{(u \pm v)t}{\frac{x}{u}\left(1 \pm \frac{uv}{c^2}\right)}(1_\Gamma) = \frac{(u \pm v)t}{t\left(1 \pm \frac{uv}{c^2}\right)}(1_\Gamma) = \frac{(u \pm v)}{\left(1 \pm \frac{uv}{c^2}\right)}(1_\Gamma)$$

$$w = \frac{u \pm v}{1 \pm \frac{uv}{c^2}}(1_\Gamma) = \frac{u \pm v}{1 \pm \beta_u \beta_v}(1_\Gamma)$$

$$w = \frac{u \pm v}{1 \pm \frac{uv}{c^2}}(1_\Gamma) = \frac{c^2}{c^2}\left(\frac{u \pm v}{1 \pm \frac{uv}{c^2}}\right)(1_\Gamma) = \left[\frac{(u \pm v)c^2}{(c^2 \pm uv)}\right](1_\Gamma)$$

Therefore c^2 is modified by the multiplicative factor $(u \pm v)$ in the numerator and by the additive factor $\pm uv$ in the denominator.

For $m = 1$, note that

$$P_w \triangleq (m_0 \Gamma) w = (m_0 \Gamma) \left[\frac{u \pm v}{1 \pm \frac{uv}{c^2}} \right] (1_\Gamma) = (m_0 \Gamma) \left[\frac{(u \pm v)(c^2)}{(c^2 \pm uv)} \right] (1_\Gamma)$$

However, in the inertial frame $v = c$ if

$$\psi \triangleq c\tau + v\tau'$$
$$\psi^* \triangleq c\tau - v\tau'$$
$$\psi^* \psi = (c\tau)^2 + (v\tau)^2$$

by conjugation, then $P_v = (m_0(v)\Gamma)[1_{c^2})(1_\Gamma)$; so $P_v = P_c = (m_0 c)$

Note that

$$\psi + \psi^* = (c\tau + v\tau') + (c\tau - v\tau') = 2(c\tau)$$
$$h^2 = 2(ct)(ut') = (cu)(\tau\tau') = 0 \Leftrightarrow u = 0$$

Decomposition of $\beta = \frac{v}{c}$

$$\beta = \frac{v}{c} = \frac{x_v}{t_v} \frac{t_c}{x_c}$$

Assume $x \triangleq x_v = x_c$, so that the distance (ruler) traveled by an observer with speed v will be the same as the distance "ruler" traveled by an observer with speed c

$$\beta = \frac{t_c}{t_v} \equiv \frac{t}{t'} \quad \text{for radiation only } t' \geq t, \ \beta \leq 1$$

Then for a given distance, the observer with speed c will take longer to travel the distance x than the observer with speed v.

Conversely, if $t \triangleq t_v = t_c$, $\beta = \frac{v}{c} = \frac{x_v}{x_c}$, $x_c \geq x_v$ the observer with “clock” t_c will travel farther than an observer with “clock” t_c ($x_c \geq x_v$

Note, however that $2\left[\frac{\beta}{(x'/x)}\right] = \frac{t}{t'}(1_{x'})\left(\frac{1}{1_x}\right) = \frac{t}{t'}2\left[(1_{x'})\left(\frac{1}{1_x}\right)\right]$, $x \triangleq x_c$, $x' \triangleq x_v$ so that $2\left[(1_{x_v})\left(\frac{1}{1_{x_c}}\right)\right] = \log_{\left(x_v/x_c\right)}\left(x_v/x_c\right)^{2\left(x_v/x_c\right)}$ and similarly for $\tau = \frac{\tau}{\tau'}$

Note that in first (coordinate) order

$$\psi \triangleq t + t'$$
$$\psi^* \triangleq t - t'$$
$$\psi + \psi^* = 2t$$
$$\psi - \psi^* = 2t'$$

But in second order coordinate time:

$$\psi\psi^* = t^2 + (t')^2$$

And similarly for coordinate length

$$\psi\psi^* = x^2 + (x')^2$$

Together,

$$\psi = x + t$$
$$\psi^* = x - t$$
$$\psi + \psi^* = 2x$$
$$\psi - \psi^* = 2t$$

And $\psi\psi^* = x^2 + t^2$

Compare this with the expression

$$\varphi = x + t$$
$$\varphi^2 = (x+t)^2 = (x^2 + t^2 + 2xt)$$

Where $h^2 \triangleq 2xt$ characterizes the interaction of space and time.

Electromagnetism

Electromagnetism can be represented by revising the Lorentz force in the following way:

$F = mA = q\left[\varepsilon_0 E + \mu_0 B\right]$, so Newton's Third Law (equal and opposite forces) is represented by the expression

$$(F)^2 = (mA)^2 = q^2\left[\varepsilon_0 E + \mu_0 B\right]^2 = q^2\left[(\varepsilon_0 E)^2 + (\mu_0 B)^2 + 2(\varepsilon_0 E)(\mu_0 B)\right]$$

For an invariant $m = 1,\ q = 1$ and $,\tau = 1$ this becomes (radial coordinates)

$\pi(F)^2 = \pi\left(1_{q/m} A\right)^2 = \pi\left[\varepsilon_0 E + \frac{\mu_0 B}{r_d}\right]^2 = \pi\left[(\varepsilon_0 E)^2 + \left(\frac{\mu_0 B}{r_d}\right)^2 + 2(\varepsilon_0 E)\frac{(\mu_0 B)}{r_d}\right]$ where the term

$2\pi(\varepsilon_0 E)\frac{(\mu_0 B)}{r_d} = 2\pi\frac{(\varepsilon_0 \mu_0)(EB)}{r_d} = E\frac{(2\pi B)}{(c\tau)^2} \triangleq \frac{1}{(c\tau)^2}(2EB), r_d \triangleq (c\tau)^2$ which suggests a

$\frac{1}{(r_d)^2} = \frac{1}{(c\tau)^4},\ \tau = 1$ law for the interaction term of the E and B for the speed of light constant at sea level, with the understanding that the "speed of light" is actually derived from the permeability and permittivity force constants (ε_0 and μ_0) from Gauss's and Coulomb's force laws via Maxwell's equations. However, note that $(\varepsilon_0 E)$ and $(\mu_0 B)$ are not vectors in this context, since

$$\left[(F)_{m=q=1}\right]^2 = \left[(\varepsilon_0 E)^2 + (\mu_0 B)^2 + 2(\varepsilon_0 E)(\mu_0 B)\right] = Tr\begin{vmatrix}(\varepsilon_0 E)^2 & 0 \\ 0 & (\mu_0 B)^2\end{vmatrix} + \det\begin{vmatrix}(\varepsilon_0 E) & (\varepsilon_0 E) \\ -(\mu_0 B) & (\mu_0 B)\end{vmatrix}$$

Quarks

Quarks can be characterized by the expression

$\varphi = r + g + b$, so that

$$\varphi^2 = \left(r + g + b\right)^2 = r^2 + g^2 + b^2 + \operatorname{Re} m(r, g, b, 2)$$
$$= \left[r^2 + g^2 + b^2\right) + \left[rg + rb + gr + gb + br + bg\right]$$

Where $\operatorname{Re} m(r, g, b, 2) = \left[rg + rb + gr + gb + br + bg\right]$ is the interaction term. Note that if only two of the elements are interacting, then

$$\varphi^2 = \left(r + \left(g + b\right)\right)^2 = r^2 + \left(g + b\right)^2 + \operatorname{Re} m(r, g, b, 2) =$$
$$r^2 + \left(g^2 + b^2 + 2gb\right)^2 + \operatorname{Re} m(g, b, 2)$$

Where if integers, r is odd prime and $2gb$ is even, so g and b are odd (primes) and $g^2 + b^2$ is even: via Goldbach's Theorem (my proof).

This can be extended to multinomials and different powers, but I don't have the spacetime to write it here.

Quantum Mechanics

It is important to emphasize that the following context only refers to radiation in the context of the RUC, where the function relations are trigonometric. It does not address absorption where the functional relations are hyperbolic. (see the RUC)

Classical Quantum Mechanics is based on the identities $\psi(\theta) = e^{\theta}$, $\frac{d\psi}{d\theta} = \theta e^{\theta}$, $i \triangleq \sqrt{-1}$, and the identity $e^{i\theta} = \cos\theta + i\sin\theta$, and the deBroglie relation $\theta \triangleq Px - Et$, where $E_0 \triangleq Et \equiv (c\tau)^2 \equiv (\cos\theta)^2$ is interpreted as the initial state and $E_v \triangleq P_v \equiv (v\tau')^2 \equiv (\sin\theta)^2$ (Note that these terms express equal and opposite forces). Note that since $\sin(-\theta) = -\sin\theta$, the deBroglie relation can be interpreted as $\sin[-(Et - Px)] = -\sin[(Px - Et)]$ o that the initial state is greater than the change of state ($E_0 > E_v$) so the change is positive.

Note the identity $(1_\theta)^2 = \cos^2\theta + \sin^2\theta = \left(\frac{\theta}{\theta}\right)^2$ where $\log_{1_\theta}(1_\theta)^{2(1_\theta)} = 2(1_\theta)$ (That is, the base (variable) θ not the integer 1.

The full expression (revisited)

The full expression of interaction is given by

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

,where $2(c\tau)(v\tau')$ is the interaction term for two particles in a single dimension.

Radiation ($\tau' < \tau,\ v < c$)

For radiation, this can be expressed as

$(1_{c\tau'})^2 = (\cos\theta)^2 + (\sin\theta)^2 + 2(\cos\theta)(\sin\theta)$ (see RUC)

$E_f = E_i + E_v \pm \Delta E \equiv E_i \pm h^2$, $E_i \geq E_v \pm \Delta E$ implies that $E_f \leq E_i$

Consider the conjugate expressions $\psi = \cos\theta + i\sin\theta$ where the “i” is merely a tag to indicate that

$$\psi = \cos\theta + \sin\theta \equiv \cos\theta + i\sin\theta$$
$$\psi^* = \cos\theta - \sin\theta \equiv \cos\theta - i\sin\theta$$

So that the expression $\psi\psi^*$ is to be evaluated as a conjugation:

$$\psi\psi^* = (\cos\theta + \sin\theta)(\cos\theta - \sin\theta) = \cos^2\theta + \sin^2\theta + \left[\sin\theta\cos\theta - \sin\theta\cos\theta\right] = \cos^2\theta + \sin^2\theta$$

Note that not only is the interaction term $2\sin\theta\cos\theta$ eliminated by conjunction, but the factor $\left[\sin\theta\cos\theta - \sin\theta\cos\theta\right]$ is not multiplied by 2 for $\left[2\sin\theta\cos\theta - 2\sin\theta\cos\theta\right] = 0$

Note that $\left(1_{c\tau'}\right)^2 = \cos^2\theta + \sin^2\theta + 2\cos\theta\sin\theta \neq \psi\psi^*$ because of the interaction term where

$$\left(1_{c\tau'}\right)^2 = \psi\psi^* + 2\cos\theta\sin\theta$$

(Compare this with the Pythagorean triple $(3,4,5) \Rightarrow 5^2 = 3^2 + 4^2$ vs the expression

$7^2 = 3^2 + 4^2 + 2(3)(4)$ and note that the count in terms of units is only preserved in the latter expression ($5 \neq 3+4$).

Consider the expression $\psi(\theta) = e^{\theta}$ where $\theta = \cos\theta + i\sin\theta$ for $\theta = 0$, so that

$\psi(\theta) = e^{\cos\theta + i\sin\theta} = e^{0+i\sin\theta} = \left(e^0\right)e^{i\sin\theta} = (1_{e^0})e^{i\sin\theta} = \left(e^0\right)\left(e^0\right) = (1_{e^0})^2$, where $2 = \log_{1_{e_0}}\left(1_{e_0}\right)^2$

This means that $\theta = 0$ implies that $\tan\theta = \left(\dfrac{\gamma\beta}{1_{c\tau}}\right)^2 = 0$ in the RUC so that $\tau' = \tau,\ \beta = 0 \Leftrightarrow v = 0$ for

$c\tau \neq 0$

Then $\theta = 0$ implies that, so that

$$\left(E_t - E_v\right) = \left(\left(mc^2\right) - P_c\left(x_c\right) - \right) = \left(\left(mc^2\right)t - (mc)(ct)\right) = \left(mc^2 - mc^2\right)t = 0t = 0 \text{ for } x_c = c\tau_c$$

This is valid for any “inertial frame” defined by a single “velocity” $v \equiv c$, so that the change in “velocity” is 0 for that “frame”.

That is, $\psi^*\psi = \left(c\tau'\right)^2 \Leftrightarrow \left(v\tau'\right)^2 = 0$ implies that

in the relativistic Schrodinger equation if relativity for $E_v = -(v\tau')$ is applied, since the equation amounts to $H = -i\dfrac{\partial H}{\partial t}\left(e^0\right)^2 - i\dfrac{\partial H}{\partial t}(1)^2 = 0 \equiv (0=0)$ (i.e., the “entropy” $2(c\tau)(v\tau') = 0$ and

(However, see remarks on Calculus below)

Again, it is important to emphasize that both Special Relativity and (even) classical quantum mechanics only apply to radiation, not absorption, and both refer to invariant "frames" defined only by a single "velocity" (e.g. c) which does not interact with any other "frame" defined by v

This applies to all functions defined by "wave equations", which are affine vectors, including the spacetime diagram where $t \perp x$ so that x does not interact with t

$$\psi\psi^* \triangleq x^2 + t^2$$
$$\varphi^2 = x^2 + t^2 + 2xt$$

, where $h^2 = 2xt = 2(c\tau)(v\tau')$ is the interaction term where ($x \triangleq (c\tau),\ t \triangleq (v\tau')$)

Fermions

Note that the interaction element $h^2 = 2\sin\theta\cos\theta$ is always positive, since $-\sin(\theta) = \sin(-\theta)$ in the quadrants of the RUC that are "negative"); (i.e., for $\pi < \theta < 2\pi$, and that $h^2 < (\cos\theta)^2 + (\sin\theta)^2 = \psi\psi^*$. If this interaction term "breaks off" from the full expression as a separate particle, it no longer interacts with $\psi\psi^*$, and becomes an "observable" at some sensor at a distance $\frac{1}{r^2}$ (see the section on electromagnetism). If $r^2 > (c\tau)^2, \tau = 1$ then permeability parameter has increased, due to a field/particle in the path after ejection, corresponding to an energy decrease in the observable relative to that observed on the surface of the earth (i.e., the "red shift" for identical particles in the local source and distant sensor)

(In this context, it implies that the elements of $\psi\psi^*$ are prime numbers, unless they are related by a further interaction energy (e.g., protons and electrons related by neutrinos).

However, $h^2 = 2\sin\theta\cos\theta$ can now be positive or negative considered independently from $\psi\psi^*$, so that plotting h^2 vs. $2\sin\theta\cos\theta$ over the interval 0 to 2π yields positive $\sin\theta\cos\theta$ in the upper plane and $-\sin\theta\cos\theta$ in the lower plane, where the RUC only expresses $h^2 = r_{\text{int}}$ This corresponds to (e.g.) protons ($\cos\theta$) and electrons ($\sin\theta$), where $\sin\theta << \cos\theta$, but can also be applied to any (e.g. gravitational) interaction (on much larger scales) or smaller particles (on smaller scales).

Of course, r_{int} can also interact with other particles along its journey, causing it to radiate (absorption would never be observable) depending on whether the "spin" ($S^2 = \sin\theta\cos\theta,\ S = \frac{h}{\sqrt{2}}$) is positive (absorption) or negative (radiation) of the new interaction. Since only consequent radiation can be observed, this corresponds to an observed loss of energy from the initial state ("red shift")

(Two ejected particles (possibly from different sources) with the same sign of Spin repel, and opposite sign attract, with the repulsion/attraction) decreasing as $\frac{1}{r^{\text{int}}}=\frac{1}{h^2}\ h^2=r_{\text{int}}$) relative to the sensor.

Consider the expression

$$e^{\theta}\triangleq e^{\varphi},\ \varphi=\cos\theta+\sin\theta$$
$$e^{\varphi^2}=e^{\left(\cos^2\theta+\sin^2\theta+2\sin\theta\cos\theta\right)}\neq e^{(\psi\psi^*)}=e\left(\cos^2\theta+\sin^2\theta\right)$$

Because of the interaction term $2\sin\theta\cos\theta$, and thus inconsistent with the expressions

$\psi\triangleq e^{i\theta}=\cos\theta+i\sin\theta$ and $\psi^*\triangleq\left(e^{i\theta}\right)^*=\cos\theta-i\sin\theta$ where $\psi\psi^*=\cos^2\theta+\sin^2\theta$

Note on the Fundamental Theorem of Calculus

$$\varphi(x) \triangleq f(x) = \int_0^x f'(x)dx + k(x)$$

$$[\varphi(x)]^2 = [f(x)]^2 = \left[\int_0^x f'(x)dx\right]^2 + [k(x)]^2 + 2\left[\int_0^x f'(x)dx\right][k(x)]$$

$$= x^2 + x'^2 + 2xx',\ x \triangleq \int_0^x f'(x)dx,\ x' \triangleq k(x)$$

, where $k(x)$ is the constant of integration and all variables are in terms of unit integers, where $1_x \triangleq \frac{x}{x} = \log_{1_x}(1_x)$.

$$\psi \triangleq \int f'(x) + k(x)$$

$$\psi^* \triangleq \int f'(x) - k(x)$$

$$\int f'(x) \geq k(x)$$

$$\psi + \psi^* = 2\int f'(x)$$

$$\psi - \psi^* = 2k(x)$$

$$\psi\psi^* = \left[\int f'(x)\right]^2 + [k(x)]^2 = \left[\int f'(x) + k(x)\right]\left[\int f'(x) - k(x)\right]$$

$$= \left[\int f'(x)\right]^2 + [k(x)]^2 + \left\{\left[\int f'(x)\right][k(x)] + [k(x)]\left[\int f'(x)\right]\right\}$$

$$\left[\int f'(x)\right]^2 + [k(x)]^2 + \left\{\left[\int f'(x)\right]\otimes[k(x)] - \left[\int f'(x)\right]\otimes[k(x)]\right\} = \left[\int f'(x)\right]^2 + [k(x)]^2 + 0$$

$$\varphi^2 = \psi\psi^* + 2\left[\int f'(x)\right][k(x)]$$

Where the cross-products $a\otimes b + b\otimes a = a\otimes b - a\otimes b = 0$ have been eliminated by conjugation, and the interaction term is given by $h(x)^2 = 2\left[\int f'(x)\right][k(x)] = 2S^2,\ S^2 \triangleq \left(\sqrt{\left[\int f'(x)\right]}\right)^2\left(\sqrt{[k(x)]}\right)^2$.

Note that $h(x)^2$ is only defined in 2nd order (as an interaction term between two particle/fields), and that complex numbers are not required in this analysis.

Consider the expression

$$g(x,h) = f(x) + f(x+h)$$
$$g(x,h)^2 = f(x)^2 + f(x+h)^2 + 2f(x)f(x+h)$$
$$\lim_{h\to 0} g(x,h)^2 = \left[f(x)^2 + f(x)^2\right] + 2f(x)^2 = 4\left[f(x)\right]^2$$

Compare this with the expression $4\left(1_x\right)^2 = \left(1_x\right)^2 + \left(1_x\right)^2 + 2\left(1_x\right)^2$, $1_x \triangleq \frac{x}{x}$, where

$$4\left(1_x\right)^2 = \log_{\left(1_x\right)^2}\left(1_x\right)^{4\left(1_x\right)^2}$$

$$\left[\left(1_x + 1_x\right)^2\right] = \left[1_x + 1_x + 2\left(1_x\right)\right] = 4\left(1_x\right) = 4\log_{1_x}\left(1_x\right)^{4\left(1_x\right)}$$

$$V = \left[\left(\frac{1}{\sqrt{3}} + \frac{1}{\sqrt{3}}\right)^2\right]\pi r^3 = \left[\frac{1}{3} + \frac{1}{3} + 2\left(\frac{1}{3}\right)\right]\pi r^3 = \frac{4}{3}\pi r^3 = r\left(\frac{4}{3}\pi r^2\right)$$

Conjugation of f(x)

$$\psi(x,h) = f(x) + f(x+h)$$
$$\psi(x,h)\left[\psi^*(x,h)\right] = f(x)^2 + f(x+h)^2$$
$$\lim_{h\to 0}\psi(x,h)\left[\psi^*(x,h)\right] = \left[f(x)^2 + f(x)^2\right] = 2\left[f(x)\right]^2$$

Note: General Relativity depends on calculus rather than the multinomial expansion for $n = 2$