Boundary Conditions and interactions between forces

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Group operations

If the universe exists then the concept of existence is characterized by the group operation of addition "+". A set (addition group) of n identical particles $\{\#\}_n = n(1)$ where (1) represents a single group element and $a := \{\#\}_n$ The general characterization of the group is represented by a single symbol $a := \{\#\}_n$ A different group with the same elements is represented by $b := \{\#\}_m$ The sum of the two groups is given by $c := \{\#\}_{(n+m)} = \{\#\}_n + \{\#\}_m$ where $c = a + b$ If $b = na \leftrightarrow c = a(1+n)$

The individual elements of the groups are invariant, and so are represented by prime numbers, where each group is prime with respect to its base: $a = a\left(\frac{a}{a}\right) := a(1_n)$ where (1_n) is "unity to the base n".

Note that for Prime Numbers, Goldbach's conjecture "Every even number is the sum of two primes" is immediately satisfied by the expression $n + n = 2n$ since every number n is prime to I ts own base.

Elastic Collisions

In the context to follow, a particle is defined as a group element without extension (a "point" particle)

The characterization of group interaction is characterized by the group operation of multiplication "$\times$"; it is composed of groups of particles and fields that either interact or do not. A group of particles that do not interact is characterized only by the addition operation, so it just exists. If a group of particles interacts with another, then the resulting object is called a field – if the particles are invariant, then the field is without the operation of division, and interactions do not change the properties of either group.

Note that the product of groups of prime numbers is itself prime $ab = ab\left(\frac{ab}{ab}\right) = ba\left(\frac{ba}{ba}\right)$ where the multiplication operation is indicated where possible by juxtaposition: $a \times b \equiv ba$ and is commutative: $ab \equiv ba$ The process of multiplication between two invariant particles is called a "collision" and the fact that the values of the particles do not change characterizes the collision as "elastic" and again the elements are represented by prime numbers.

Boundaries for Force/Mass Creation

For a single one particle in an otherwise empty universe the process of force creation is characterized by the relation $f = ct$ where c is the force creation rate and t is the force creation time, so that $c = \frac{f}{t}$ where the force has "spacetime coordinates" (anywhere, anywhen)

If the Universe exists of multiple particles, then a vacuum is defined as a region in which no particles exist.

For two particles, two particles in three dimensions can be visualized as created on the surface on the boundary of some arbitrary vacuum. A force at the boundary of a vacuum that is no longer interacting with any other particles is no longer changing (accelerating) but is traveling with a constant velocity (defined as positive if toward the collisiion), so that $P := f_0 v = m' = m_0 v$ where P is called the "momentum of the particle, $P = m_0 v$ represents the constant force at the boundary at the instant of transition and m_0 represents the stationary mass on the border without motion relative to it.

Particles can only interact if the collide in one dimension, where the borders of the imaginary boundary are perpendicular to the directions of motion; the interaction is characterized by the expression

Such boundaries are:

1. "Sources" in one dimension
2. "Areas" in two dimensions
3. "Spheres" in three dimensions

Particles can only interact ("collide", "multiply") in one dimension where the point of collision is at the center of the geometric object defined above; otherwise they will miss each other and remain single forces with momentum P. For areas, the point of origin is at $(x, y) = (0,0)$ where the point $(0,0)$ is "(anywhere, anywhen") on the surface of the flat perpendicular boundary, and is "(anywhere, anywhen") on the surface of the sphere where the interaction line is perpendicular to the surface (the radius of curvature).

The collision at the center is characterized by the expressions:

$$P = f_{a=0} = m' = \left(\frac{m'}{2}\right) + \left(\frac{m'}{2}\right)$$

$$P^2 = \left(f_{a=0}\right)^2 = \left(\frac{m'}{2}\right)^2 = \left[\left(\frac{m'}{2}\right) + \left(\frac{m'}{2}\right)\right]^2 = \left[\left(\frac{m'}{2}\right)^2 + \left(\frac{m'}{2}\right)^2\right] + 2\left(\left(\frac{m'}{2}\right)\right)\left(\left(\frac{m'}{2}\right)\right)$$

“Coordinates”

Since P^2 no longer has a velocity associated with it at the collision where $v = 0$, the symbol $m'_{(a=v=0)} = m_{(0,0)}$ which can now be taken as the center of a “coordinate system” where $x = ct$ is redefined as the relation between a ruler x, a ruler creation rate v, and a ruler creation time t, where x is the distance from a border to the center, so that for both particles $2(x) = 2(vt) \leftrightarrow x = vt$.

Note that this relation can be interpreted as the mass creation from a value of $2m' = 0$ at the boundary to the collision at $2m' = 2x$ for $x = vt$ interpreted as mass creation parameters.

Non-Elastic Collisions

If the collision change the values of the particles, then they are not prime, and the process is represented by the relation $(ct')=(ct)\pm(vt')$ where all terms exist (are positive). The terma

1. (ct) represents the initial state ($f_{(ct)}$)
2. (vt') represents a change to that state ($f_{(vt')}$)
3. (ct') represents the final state of the interaction $f_{(ct')}$.

So that $f_{(ct')}=f_{(ct)}\pm f_{(vt')}$

Absorption is represented by the force expressions

$(ct')_+=(ct)+(vt')$ for $(vt')\leq(ct)$ where $(ct')_+=n(ct)+(vt')$ for $ct'>ct$ and

$(ct')_+=(ct)_++(ct)_+=2(ct)_+$ for $(vt')=(ct)$

$$(ct')_+^{\,2}=\left[(ct)+(vt')\right]^2=\left[(ct)^2+(vt')^2\right]+2(ct)(vt')$$
$$\pi(ct')_+^{\,2}=\pi\left[(ct)+(vt')\right]^2=\left[\pi(ct)^2+\pi(vt')^2\right]+(ct)\left[2\pi(vt')\right]$$
$$(ct)\left[2\pi(vt')\right]=rC,\quad r=ct,\quad C=\left[2\pi(vt')\right]$$

Radiation is represented by the process $(ct')_-=(ct)-(vt'),\ (vt')\leq(ct)$

(Note that $(ct')_->0$)

$$(ct')_+^{\,2}=\left[(ct)-(vt')\right]^2=\left[(ct)^2+(vt')^2\right]-2(ct)(vt')$$
$$\pi(ct')_+^{\,2}=\pi\left[(ct)+(vt')\right]^2=\left[\pi(ct)^2+\pi(vt')^2\right]-(ct)\left[2\pi(vt')\right]$$
$$(ct)\left[2\pi(vt')\right]=rC,\quad r=ct,\quad C=\left[2\pi(vt')\right]$$

Collisions involving invariant particles (Prime Numbers)

In this discussion we will refer to prime numbers where $c = a \pm b$, where in the case $c = a - b,\ b \le a$

$a = a\frac{a}{a} = a(1_a)$, and so is a prime number, with (1_a) "odd". The same is true for b and c. In the context below, the context is with respect to Pythagorean Triples, and we discuss the case $(5,4,3)$ where $c = 5$. $a = 4$, and $b = 3$

Absorption ($c = a + b$)

1. Case 1: $b = a$: $c = a + a = 2a$
2. Case 2: $0 < b < a$; $c = a + b,\ 0 \le b < a$
3. Case3: $c > 2a + b,\ 0 \le b < a$

   Note that: $c = a \Leftrightarrow b = 0$

Case 2.

$$b := \delta$$

Notice that is the area of a right triangle with sides a and b where the hypotenuse is $\psi = \sqrt{a^2 + b^2}$ so that $\psi^2 = a^2 + b^2$ and the four areas are those of the four quadrants of the RUC ("Relativistic Unit Circle") The total count is then the square of the hypotenuse plus the four areas of the interaction term $4\left[\frac{1}{2}ab\right] = [2ab] = [ab + ab]$, the latter term corresponding to the sum of the two areas in the upper and lower plane. These areas represent the entropy in each of the quadrants.

The Pythagorean Triple $(5,4,3)$ will be used which shows the count is be preserved in its extension to second order, which can be extended to any Pythagorean Triple. Pythagorean Triples where $c^2 = a^2 + b^2$ are characterized by the absence of the product ab in the real numbers.

Define

$$a = a\cos(0)$$

$$b = \pm\delta = \pm\tan\psi = \left(\frac{b\sin\theta}{a\cos(0)}\right) = \left(\frac{b\sin\theta}{a}\right),\ b < a$$

Where θ is the angle between a and the hypotenuse $\sqrt{5^2} = 25$

Note that non-interacting particles can be characterized by the vectors

$\# = \begin{vmatrix} 4 \\ 0 \end{vmatrix} + \begin{vmatrix} 0 \\ 3 \end{vmatrix}$ where $\#^2 = Tr\begin{vmatrix} 4 & 0 \\ 0 & 0 \end{vmatrix}^2 + Tr\begin{vmatrix} 0 & 0 \\ 0 & 3 \end{vmatrix}^2 = 16 + 9 = 25$ but the determinant is not defined for each vector individually, and the component-by-component multiplication is zero. The vectors therefore do not interact (have a common origin) so are independent of each other. (In two dimensions, they must be represented as parallel lines, in one dimension, as lengths separated from each other with no common origin.)

The expression for interacting elements then becomes:

$$\#^2 = Tr\begin{vmatrix} 4^2 & 0 \\ 0 & 3^2 \end{vmatrix} + Det\begin{vmatrix} 4 & 4 \\ -3 & 3 \end{vmatrix} = [25] + [24]$$

$Det\begin{vmatrix} 4\cos(0) & 4\cos(0) \\ -3\sin\theta & 3\sin\theta \end{vmatrix}$ is represented trigonometrically by

$Det\begin{vmatrix} 4\cos(0) & 4\cos(0) \\ 3\sin(-\theta) & 3\sin\theta \end{vmatrix} = 12\cos(0)\sin\theta + 12\cos(0)\sin(-\theta)$ where both terms are positive but $\pm$ refers to rotations of θ corresponding to increasing or decreasing changes in the areas of the triangles in the upper and lower halves of the circle. In general, for all areas increasing, the rotation is CCW (positive rotation) in the upper half and CW (negative rotation) and vice versa for decreasing areas, where the limits of the sums of the increasing are from 0 at $\delta = b = 0$ to $\delta = b = 3$ with the total count from 16 $(b = 0)$ to 49 $(b = 3)$

Consider the relations:

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

But the imaginary term relation has been shown above to be

$i^2 = \sqrt{-1}\sqrt{-1} = \sqrt{(-1)(-1)} = \sqrt{1^2} = 1 \neq -1$ so is not second order as required to be multiplied by 3^2

That is, the actual term is relevant only in the context of the complete count where

$$49 = [\psi^*\psi] + [24] = [25] + [24] = [5^2] + 4\left[\frac{1}{2}(4)(3)\right]$$

This is because even in the lower half of the complex plane $-\sin\theta = \sin(-\theta)$ for the change of total entropy so the distinction is irrelevant.

The sum of the existing and the interaction terms

Restating the above:

$$\#_{(+)} := a+b = 4+3 = 7$$

$$\left(\#_{(+)}\right)^2 = \left(a+b\right)^2 = 49 = 7^2 = (4+3)^2 = [4^2+3^2]+\left[2(4)(3)\right] = [16+9]+\left[2(12)\right]$$

$$49 = \left[25\right]+\left[24\right] = \left[5^2\right]+4\left[\frac{1}{2}(4)(3)\right]$$

Note that $\left(\#_{(+)}\right)^2 = 49$ is an odd number.

The interpretation can be made that it expresses a mass characterized by "equal and opposite" forces where

$$\#_{(+)} := f_+ = 7 = \frac{7}{2}+\frac{7}{2}$$

$$\left(\#_{(+)}\right)^2 := \left(f_+\right)^2 = m_+ = 49 = \left[\frac{7}{2}+\frac{7}{2}\right]^2 = \left[\left(\frac{7}{2}\right)^2+\left(\frac{7}{2}\right)^2\right]+2\left[\left(\frac{7}{2}\right)\left(\frac{7}{2}\right)\right]$$

Where the term $\left[\left(\frac{7}{2}\right)^2+\left(\frac{7}{2}\right)^2\right]$ characterizes the existence of the "bare" but interacting particles and the term $2\left[\left(\frac{7}{2}\right)\left(\frac{7}{2}\right)\right]$ characterizes their interaction. Note that the "existence" term is larger than the interaction term.

The difference between the existing and the interaction terms

The difference between the “bare” term of the particles and their interaction is given by:

$$\#_{(-)} := a-b = 4-3 = 1$$
$$\left(\#_{(-)}\right)^2 = (a-b)^2 = 1^2 = (f_-)^2 = m_- = (4-3)^2 = [4^2+3^2]-\left[2(4)(3)\right] = [16+9]+\left[2(12)\right]$$
$$1^2 = [25]-[24] = \left[5^2\right]-4\left[\frac{1}{2}(4)(3)\right]$$

With the interpretation:

$$f = 1 = \frac{1}{2}+\frac{1}{2}$$
$$m_{(-)} := 1^2 = f^2 = \left[\frac{1}{2}+\frac{1}{2}\right]^2$$

Note that both the sum and the difference between the “bare” particles and their interaction) is second order (i.e, “equal and opposite” unit forces combining to produce a mass.)

Similarly, $m_{(+)}$ is the amount that can be added to the “interaction term”

$2ab+1^2 = \left(\sqrt{24}\sqrt{1}\right)^2 + 1^2 = 25\left(1^2\right)$ to produce two equal non-interacting particles

$5^2 = 25 = 2(4)(3)+1 = 2(12)+1$ so that the existence and interaction terms are again equal and the system is now represented by an even number as the sum of two $50 = 7^2+1^2 = 25+25$ where $25 = (25)\left(\frac{25}{25}\right) = 25\left(1_{25}\right)$ Note that $m_{(+)}$ was added to $b^2 = 9$ so that the existence term becomes $\left[16+10\right] = 25$

Similarly, $m_{(-)}$ is the amount that can be subtracted from the “existence” term $a^2+b^2 = 25$ to produce two equal non-interacting particles $5^2-1^2 = 24 = 2(4)(3) = 2(12)$ so that the existence and interaction terms are equal and even, so the result becomes $49 = 7^2-1^2 = 48$ and the system is now represented by the sum of two primes $48 = 24+24$ where $24 = (24)\left(\frac{24}{24}\right) = 24\left(1_{24}\right)$ Note that $m_{(-)}$ was subtracted from $a^2 = 16$ so that the existence term becomes $\left[15+9\right] = 24$

Setting the system as:

$$c = 1 + \delta$$
$$c^2 = (1+\delta)^2 = \left[1^2 + \delta^2\right] + \left[(1)2(\delta)\right]$$

With "Cartesian" coordinates in one dimension so that

$x = 1,\ 0 \le \delta x < x$ yields

$$\varphi = 1 + \delta$$
$$\varphi^2 = (1+\delta x)^2 = \left[1^2 + \delta x^2\right] + \left[(1)2(\delta x)\right]$$

For "radial" coordinates:

$$r = 1,\ \ 0 \le \delta r < r$$
$$\varphi = 1 + \delta r$$
$$\varphi^2 = (1+\delta r)^2 = \left[1^2 + \delta r^2\right] + \left[(1)2(\delta r)\right]$$
$$\pi\varphi^2 = \pi(1+\delta r)^2 = \pi\left[1^2 + \delta r^2\right] + \left\{(1)\left[2\pi(\delta r)\right]\right\}$$

Where

$$\left\{(1)\left[2\pi(\delta r)\right]\right\} = \left\{rC_{\delta r}\right\},\ C_{\delta r} = 2\pi(\delta r)$$

Case 3. $c = na + b, n \geq 1,\ 0 < b < a$, $c = na + \delta, n \geq 1,\ 0 < \delta < a$

In this case $na = \sum_{1}^{n} a_n = a_1 + a_2 + \ldots a_n$

Then

$$c = na + b, n \geq 1,\ 0 < b < a$$
$$c^2 = (na + b)^2 = (na + \delta)^2 = \left[(na)^2 + \delta^2\right] + 2(na)(\delta)$$
$$c^2 = \left[\left(\sum_{1}^{n} a_n\right)^2 + \delta^2\right] + \left[2\left(\sum_{1}^{n} a_n\right)\delta\right]$$

Where $\left(\sum_{1}^{n} a_n\right)^2$ is calculating using the multi-nomial theorem for the case $n = 2$, noting that

$$\left(\sum_{1}^{n} a_n\right)^2 \neq \left(\sum_{1}^{n} (a_n)^2\right)$$

$\lim_{n \to \infty} c^2 = \lim_{n \to \infty} \left(\sum_{1}^{n} a_n\right)^2 = \lim_{n \to \infty} \left(\sum_{1}^{n} (a_n)^2\right)$ as $n \to \infty$ since the terms involving δ have diminishing effect on c^2 at greater values of n

$\pi c^2 = \pi\left[\left(\sum_{1}^{n} a_n\right)^2 + \delta^2\right] + \left[\left(\sum_{1}^{n} a_n\right)(2\pi\delta)\right]$ where $\left[\left(\sum_{1}^{n} a_n\right)(2\pi\delta)\right] = 2rC$ in "radial" coordinates.