Probability

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Revised 10/28/2023 Added updated discussion of Configuration Space (more to come)

Overview

Configuration Space characterizes the existence and interaction of elements independent of time in terms of position, and thus omits velocity; Phase Space is concerned with the interaction of physical elements and defines velocity as a mechanism to characterize these interactions.

Configuration Space (to be continued)

Phase Space (TBD)

Configuration Space

Consider a unit element of configuration space:

$$\varphi = 1 + 0 = 1$$

If the element is interpreted as a unit force, then a “rest” mass can be characterized by an equal and opposite interaction of forces where:

$$\varphi = 1 = \frac{1}{2} + \frac{1}{2}$$

$$\varphi^2 = \left(\frac{1}{2} + \frac{1}{2}\right)^2 = \left[\left(\frac{1}{2}\right)^2 + \left(\frac{1}{2}\right)^2\right] + \left[2(\frac{1}{2})(\frac{1}{2})\right] = 1^2$$

$$\varphi^2 = Tr\begin{vmatrix} \left(\frac{1}{2}\right)^2 & 0 \\ 0 & \left(\frac{1}{2}\right)^2 \end{vmatrix} + Det\begin{vmatrix} \frac{1}{2} & \frac{1}{2} \\ -\frac{1}{2} & \frac{1}{2} \end{vmatrix} = 1^2$$

(If the forces are not equal and opposite, see the RUC)

The transition from one element to two elements can be characterized by the relation:

$\varphi = 1 + 1\sin(\theta),\ \ 0 \le \theta \le \frac{\pi}{4}$ so that

$$\varphi^2 = \left[1 + \sin(\theta)\right]^2 = \left[1^2 + \sin^2\theta\right] + \left[2\sin\theta\right]$$

Then the limits of the expression are

$\varphi = 1,\ \ \theta = 0$

$\varphi^2 = 1^2,\ \ \theta = 0$

and

$\varphi = 1 + 1 = 2,\ \ \theta = \frac{\pi}{4}$

$\varphi^2 = (1+1)^2 = 2^2 = 4,\ \ \theta = \frac{\pi}{4}$

If the expression is represented by $\varphi = 1 + b,\ \ b < 1$ the underlying expression is trigonometric, if $b > 1$ the expression is hyperbolic.

There is much more to this story, since the process can be extended to multinomials (e.g. Quarks for $\# = 3$)

Probability

Consider the expression:

$$\psi = 1 + i\sqrt{(1)\sin\theta}$$
$$\psi^* = 1 - i\sqrt{(1)\sin\theta}$$

where $i = \sqrt{-1}$.

$$\psi\psi^* = \left[1 + i\sqrt{(1)\sin\theta}\right]\left[1 - i\sqrt{(1)\sin\theta}\right]$$
$$= 1^2 + (1)i\sqrt{(1)\sin\theta} - (1)i\sqrt{(1)\sin\theta} - i^2(1)\sin\theta$$
$$= 1^2 + (1)\sin\theta$$

Note that

$$\psi\psi^* = 1^2 + (1)\sin\theta$$
$$\frac{d(\psi\psi^*)}{d\theta} = (1)\cos\theta$$

Because 1^2 is invariant; for

$$\theta = 0, \frac{d(\psi\psi^*)}{d\theta} = (1)\cos(0) = (1)(1) = 1^2$$
$$\theta = \frac{\pi}{4}, \frac{d(\psi\psi^*)}{d\theta} = (1)\cos\left(\frac{\pi}{4}\right) = 0$$

Then $P(1) = (1)\sin\theta$ can be interpreted as the "probability" that a second element exists as a first order element and similarly for $P(1^2) = P(1)P(1) = (1^2)\sin^2\theta$, where the interaction between imagination and reality has been eliminated in the conjugation.

Note that $\frac{\partial}{\partial\theta}(\psi\psi^*) = \frac{\partial}{\partial\theta}\left[1^2 + (1)\sin\theta\right] = (1)\cos\theta$ which suggests that the expression for QM eliminates the reality part of the Hamiltonian (i.e. 1^2) and fakes reality by converting the derivative to cosine where $\cos(0) = 1$

Rest Mass

In an otherwise empty universe, non- interacting forces f are represented in first order where

$$f := \frac{f}{2} + \frac{f}{2} = f + 0 = \int_0^f df$$

A rest mass $m_0 = f^2$ can be characterized as the result of two equal interacting forces in one dimension, where

$m_0 := f^2 = \left(\frac{f}{2} + \frac{f}{2}\right)^2 = \left[\frac{f^2}{4} + \frac{f^2}{4}\right] + \left[2\left(\frac{f}{2}\right)\left(\frac{f}{2}\right)\right]$ where the term $\left[\frac{f^2}{4} + \frac{f^2}{4}\right] = \frac{f^2}{2}$ represents the existence the mass and $\left[2\left(\frac{f}{2}\right)\left(\frac{f}{2}\right)\right]$ represents the self-interaction; together they define a single mass at its own origin, where $f = f\left(\frac{f}{f}\right) = f\left(1_f\right)$ where $\left(1_f\right)$ represents unity with respect to its own base, so f is represented by a prime number. Note that $\frac{f}{2}$ is not prime and thus is represented by an odd number, so f is even by Goldbach's conjecture "Every even number is exists as the sum of two primes" so that $f + f = 2f$.

Then $m_0 = \frac{m_0}{2} + \frac{m_0}{2} = \int_0^{m_0} dm$ and

$$\left(m_0\right)^2 = \left(\frac{m_0}{2} + \frac{m_0}{2}\right)^2 = \left[\left(\frac{m_0}{2}\right)^2 + \left(\frac{m_0}{2}\right)^2\right] + 2\left(\frac{m_0}{2}\right)\left(\frac{m_0}{2}\right) =$$

$$Tr\begin{vmatrix} \left(\frac{m_0}{2}\right)^2 & 0 \\ 0 & \left(\frac{m_0}{2}\right)^2 \end{vmatrix} + Det\begin{vmatrix} \left(\frac{m_0}{2}\right) & \left(\frac{m_0}{2}\right) \\ -\left(\frac{m_0}{2}\right) & \left(\frac{m_0}{2}\right) \end{vmatrix}$$

A Second Rest Mass

A second rest mass is represented by the same process. Since the mathematics is consistent, it applies to all existing elements of any configuration space (e.g., clocks, rulers, bosons, etc.), and so will be represented by letters. Since the second rest mass may be have a different value than the first, the first mass will be represented by the color red, and the second by the color blue:

$m_0 = f^2$ and $m_0 = f^2$ so that if the two masses are equal $m_0 = m_0$ and $m_0 - m_0 = 0$ where the minus sign expresses a difference in the values of the two elements.

Transition from between masses

Consider the expression:

$\varphi := a + b\sin\theta$ where $0 \le b\sin\theta \le b \le a$ so that

$\varphi = a,\ \theta = 0$ and $\varphi = a + b,\ \theta = \frac{\pi}{4}$, with $\sin\theta$ representing the increase in φ from $\theta = 0$ to $\theta = \frac{\pi}{4}$ when $\varphi = 2a = 2b$

Then the expression:

$\varphi := a + b\cos\theta$ represents the decrease in φ from $\theta = 0$ to $\theta = \frac{\pi}{4}$ when $\varphi = a$

Interaction between masses

Interaction between the masses in configuration space is represented by multiplication be tween elements, where:

$\varphi^2 = \left(a \pm b\sin\theta\right)^2 = \left[\left(a\right)^2 + \left(b\sin\theta\right)^2\right] \pm 2\left(a\right)\left(b\sin\theta\right)$, $\varphi^2 \ge a^2 > 0$

For $\theta = 0$, $\varphi^2 = \left(a\right)^2$, and for $\theta = \frac{\pi}{4}$, $\varphi^2 = \left(a + b\right)^2 = \left[\left(a\right)^2 + \left(b\right)^2\right] + 2\left(a\right)\left(b\right)$

Setting $h^2 = \pm 2\left(a\right)\left(b\sin\theta\right) = 2S^2$ yields $\pm S = \frac{\pm h}{\sqrt{2}}$ (the conventional physics definition of “S=Spin), but that $\left[\left(a\right)^2 + \left(b\sin\theta\right)^2\right] - h^2 > 0$ so that $\varphi^2 > 0$.

However, $-b\sin\theta = b\sin(-\theta)$ corresponding to rotations in the RUC so the rotations can always be interpreted as positive in the four quadrants.

In “radial” coordinates, $\pi\varphi^2 = \pi\left(a \pm b\sin\theta\right)^2 = \pi\left[\left(a\right)^2 + \left(b\sin\theta\right)^2\right] \pm \left(a\right)\left(2\pi\left(b\sin\theta\right)\right)$ where the term:

$\pi\left[\left(a\right)^2 + \left(b\sin\theta\right)^2\right] = \pi\left(a\right)^2 + \pi\left(b\sin\theta\right)^2$

represents a sum of second order “areas” and the term:

$$(a)(2\pi(b\sin\theta)) = (a)(2\pi C) = \pm h^2 = 2(\pm)S^2, \pm S = \frac{(\pm)h}{\sqrt{2}} \text{ where } (\pm)h \geq 0 \text{ relative to } \varphi^2$$

represents the product of a “radius” a and a “circumference” $2\pi C$ and that the circumference cannot exist if there is no radius as an initial element.

Matrix Representation

If a does not interact with $b\sin\theta$, the system is represented by

$$\# := Tr\begin{vmatrix} a & 0 \\ 0 & b\sin\theta \end{vmatrix}, \#^2 = Tr\begin{vmatrix} a & 0 \\ 0 & b\sin\theta \end{vmatrix}^2 = Tr\begin{vmatrix} (a)^2 & 0^2 \\ 0^2 & (b\sin\theta)^2 \end{vmatrix} = (a)^2 + (b\sin\theta)^2$$

However, if a does interact with $b\sin\theta$, the system is represented by

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

$$= \left[(a)^2 + (b\sin\theta)^2\right] + \left[2(a)(b\sin\theta)\right]$$

, noting that the reified values of the interaction term are different than the non-interacting system, since a scales $2b$ in the interaction. The interaction term is sometimes called the change in entropy, or the "entanglement" of a prior non-entangled system.

Here the "entanglement" $\left[2(a)(b\sin\theta)\right]$ is the binding energy between a and $b\sin\theta$ where $\#^2 - 2ab\sin\theta = a^2 + (b\sin\theta)^2$

Let $r := a,\ b := b\sin\theta,\ g := \sqrt{2ab\sin\theta}$

If the system becomes "unentangled", the result is three particles represented by the matrix

$$\#^2 = \begin{vmatrix} (a)^2 & 0 & 0 \\ 0 & (b)^2 & 0 \\ 0 & 0 & (g)^2 \end{vmatrix} \text{ so that } \# = \begin{vmatrix} (a) & 0 & 0 \\ 0 & (b) & 0 \\ 0 & 0 & (g) \end{vmatrix}$$

The three particles (dare I say quarks) can then interact again in several different ways:

1. None interact:

$$\# = Tr\begin{vmatrix} r & 0 & 0 \\ 0 & b & 0 \\ 0 & 0 & g \end{vmatrix} = r + b + g$$

$$\#^2 = Tr\begin{vmatrix} r & 0 & 0 \\ 0 & b & 0 \\ 0 & 0 & g \end{vmatrix}^2 = (r)^2 + (b)^2 + (g)^2$$

2. Two of the three interact:

$$\# = \begin{vmatrix} (r+b) & 0 \\ 0 & (g) \end{vmatrix}, \#^2 = \begin{vmatrix} (r+b)^2 & 0 \\ 0 & (g)^2 \end{vmatrix}$$

$$Tr(\#) = (r+b)+(g)$$

$$Tr(\#^2) = (r+b)^2+(g)^2 = \left[r^2+b^2\right]+\left[2rb\right]+g^2$$

Or

$$\# = \begin{vmatrix} (r+g) & 0 \\ 0 & b \end{vmatrix}, \#^2 = \begin{vmatrix} (r+g) & 0 \\ 0 & b \end{vmatrix}^2 = \begin{vmatrix} (r+g)^2 & 0 \\ 0 & b^2 \end{vmatrix}$$

$$Tr(\#) = (r+g)+(b)$$

$$Tr(\#^2) = (r+g)^2+(b)^2 = \left[r^2+g^2\right]+\left[2rg\right]+b^2$$

Or

$$\# = \begin{vmatrix} (r) & 0 \\ 0 & (b+g) \end{vmatrix}, \#^2 = \begin{vmatrix} (r) & 0 \\ 0 & (b+g) \end{vmatrix}^2 = \begin{vmatrix} (r)^2 & 0 \\ 0 & (b+g)^2 \end{vmatrix}$$

$$Tr(\#) = (r)+(b+g), \qquad .$$

$$Tr(\#^2) = (r)^2+(b+g)^2 = (r^2)+\left[b^2+g^2\right]+\left[2bg\right]$$

3. All three interact:

$$\# = |r+b+g|$$

$$\#^2 = Tr|r+b+g|^2 = (r+b+g)^2 = \left[r^2+b^2+g^2\right]+\left[f(r,b,g,2)\right]$$

Where $\left[f(r,b,g,2)\right] = 2rb+2rg+2bg = 2(rb+rg+bg)$ is the interaction term in one dimension.

Complex Numbers

Let $\psi = (a+ib),\ \psi^* = (a-ib)$. Then

$$\psi\psi^* = (a+ib)(a-ib) = a^2 + b^2$$

Let $\psi = (a + b\sin\theta)$ so that $\psi^2 = (a+b\sin\theta)^2 = \left[(a)^2 + (b\sin\theta)^2\right] + \left[2(a)(b\sin\theta)\right]$, where the term $\left[2(a)(b\sin\theta)\right]$ is the interaction term between the real and imaginary components.

Pythagorean Triples

Compare the Pythagorean Theorem where $a = 4,\ b = 3$ and $a = 4,\ b = 3$ to see that

$$\varphi^2 = (a+b)^2 = \left[(a)^2 + (b)^2\right] + 2(a)(b)$$
$$= (a+b)^2 = \left[(a)^2 + (b)^2\right] + 2(a)(b)$$
$$= [\psi\psi^*] + 2(a)(b)$$

So the imaginary numbers are irrelevant when related to the full Binomial Expansion. This relationship is true for all Pythagorean Triples.

Probability of Interaction

$$\psi := a + i\sqrt{b\sin\theta}$$
$$\psi^* := a + i\sqrt{b\sin\theta}$$

$$\psi\psi^* := \left(a + i\sqrt{b\sin\theta}\right)\left(a - i\sqrt{b\sin\theta}\right) = (a)^2 + a\left(i\sqrt{b\sin\theta}\right) - a\left(i\sqrt{b\sin\theta}\right) + b\sin\theta$$
$$= (a)^2 + b\sin\theta = (a)^2 + P(b)$$

The DeBroglie relation and Quantum Mechanics

Consider the expression:

$\varphi := 1 + \sin([kx - vt]) = 1 + \sin\theta$ where $1, k, x, v, t$ are elements of configuration space, $(kx - vt) \geq 0$ and $2\pi(kx - vt) = 2\pi C$ where $\theta = C$ is a circumference.

Since the above elements are configuration elements, the expression $0 \leq [(kx) - (vt)] \leq 1$ can represent a change in energy $[kx - vt] \equiv [Px - Et]$,

a change in coordinate ruler ($k = 1,\ x = ct$) $[kx - vt] \equiv [(x) - (vt')] \equiv [(\lambda_x) - (\lambda_{vt'})]$

This expression will have:

Minimum: $\theta = 0$ when $k = 1$ and $x = vt$ so that
$C = 2\pi[kx - vt] = 2\pi[0] = 0$
$\varphi = 1 + \sin(2\pi[kx - vt]) = 1 + \sin(2\pi(0)) = 1 + \sin(C) = 1$

and

Maximum: $\theta = \frac{\pi}{4}$ so that $\sin([kx - vt]) = \sin\left(\frac{\pi}{4}\right) = 1$ so $\varphi = 1 + 1 = 2$

That is,

$$2\pi\left[kx - vt\right] = \frac{\pi}{4} \leftrightarrow 8\left[kx - vt\right] = \left[8(kx) - 8(vt)\right] = 1$$

$$\left[kx - vt\right] = \frac{1}{8}$$

Note that $8\left(\frac{1}{8}\right) = (8)2\left[\frac{1}{2}(1)(1)\right]$ where $\left[\frac{1}{2}(1)(1)\right]$ is the area of a half quadrant of the RUC