The way of the whole space and elementary particles appear

Pair production

Of

light velocity c with Planck's constant ℏ

=The GAP Space theory =

* *

Shogo Niimi
Nishigo 89, Kashima, Gamagori,
Aichi, 4430037, Japan
shogo-ni@sk2.aitai.ne.jp

* *

Contents

* *

1. Outline

First, I explain that this theory was built under some supposition and what was gotten as the result.

You say that our space was born with the Big Bang. However, I do not know that the theory explains the Big Bang itself. Also, I do not seem to express it in latest M-theory. Because, light velocity c and Planck's constant ħ are handled as the axiom that are not logically found in the M-theory. Recently, the elementary function that I led under some supposition expressed c and ħ. I thank for software and calculation ability of the computer is rising remarkably, though the way of taking variables and the way of adapting value is more important. Below, I will extract the point of this theory.

① I recognize the existence of whole space **H** where there has not a dimension.

② **H** had the phase transition by the exquisiteness combination of c with ħ.

③ **H** after the phase transition shift to 9-dimension space $\mathbf{H}^9$ that has split into real space $\mathbf{R}^3$, complex space $\mathbf{G}^3$ and imaginary space $\mathbf{I}^3$, which have three dimensions respectively.

④ Write it as follows.

$$\mathbf{H} \xrightarrow{\text{phase tr}} \mathbf{H}^9 = [\, \mathbf{R}^3 \mid \mathbf{G}^3 \mid \mathbf{I}^3 \,]$$

⑤ I call $\mathbf{G}^3$ as the gap space. This is the unit-complex-space, which can be seen like a membrane that appeared among both as the hindering of the recombination of $\mathbf{R}^3$ and $\mathbf{I}^3$.

⑥ $\mathbf{R}^3$, $\mathbf{G}^3$, $\mathbf{I}^3$ do not full split, I assume that $\mathbf{R}^3$ and $\mathbf{I}^3$ are the incomplete split which is linked by $\mathbf{G}^3$.

⑦ I show this status in the theoretical expression and get elementary function $f(\theta_j)$ from there.

$$f(\theta_j) = \pm R\omega_j \exp(\pm \sigma_j \tau) \cos \omega_j \tau$$

⑧ I discover that c and ℏ are pair production in the elementary function.

$$c = 299792458 \quad [\mathrm{m}^1 \cdot \mathrm{s}^{-1}], \qquad \hbar = 1.054571596 \times 10^{-34} \quad [\mathrm{J} \cdot \mathrm{s}^1]$$

⑨ I can assume the Sub-Bromwich=Wagner sphere in this whole space. Therefore, curvature Φ of whole space $\mathbf{H}^9$ has

$$\Phi = 1/w.$$

$$= 1.10267894 \times 10^{-45} \quad [\mathrm{s}^1 \mathrm{rad}^{-1}]$$

that radius of the sphere has w. However, you are careful that has not a metric dimension.

⑩ The spin quantum number (0, 1/4, 1/2, 1, 2, 4) is gotten from the secondary expression what I admit that the elementary function has a vector. Also, the spin angular momentum ($\sqrt{3}\,\hbar/2$) of electron, and so on, is expressed there.

⑪ In the same way, I can explain why the fractional charge is not expressed there.

⑫ I explain that the quark confinement and the mixture, also history of the nucleon and the meson that are composite particles.

⑬ Explain neutrino oscillation by the technique to be same.

⑭ Actually, I have a serious question. As for it, the photon has a possibility to have mass. If it is sure, light velocity c is not maximum speed in $\mathbf{H}^9$

and I explain the observation fact that they have few speed differences between the photon and the neutrino or the same.

⑮ Four interactions are unified.

2. Concept and the interaction in the space

2-(1) Find the elementary functin

Generally, the metric space is represented in (x_1, x_2, x_3) with 3 dimensions. On the other hand, Minkowski introduced 'ict' and set space-time (x_1, x_2, x_3, ict). I suppose the existence of imaginary space i (x_1, x_2, x_3) here now. In this case, this is i (ct_1, ct_2, ct_3) rewritten. It has the extended 6 dimensions the "real imaginary space"

$$\mathbf{C}^6=[\, x_1,\, x_2,\, x_3,\, i\,(ct_1,\, ct_2,\, ct_3)] \qquad [2-1]$$

that I put this imaginary space in the Minkowski space-time. Properly, dimension x_j of the real space is replaced with ct_j by the operation of light velocity c, i.e. the photon. By the way, I cannot sense the imaginary space. However, how about do I recognize it as the time? I can explain

$$x_j \overset{-i/c}{\Rightarrow} it_j \qquad \text{or} \qquad ix_j \overset{i\ c}{\Rightarrow} t_j \qquad [2-2]$$

that suppose 'ic' is an operator. Also, it composes inverse correlation to only as the time, even if I look into the real space from the side of the imaginary space.

By the way, I seem the time are equipped with the dimensions by [2 − 1]. Actually, you should think that it is subscript only to show three dimensions of the imaginary space. Then, why dose the imaginary space have 3−D ? Bcause, if it is not formed, we cannot find the correlation between the real space and the imaginary space. In other words, this is a necessary condition.

I can rewrite relational expression [2 − 2] to

$$\mathbf{R}^3 \overset{c}{\Leftrightarrow} \mathbf{I}^3 \qquad [2-3]$$

In this way, I am easy to take oscillation of the space.

First, I state oscillation of the electronic circuit. The amplification circuit, the resonance circuit and the feedback circuit basically compose the oscillation circuit. I make signal input line V_{in}, signal output line V_{out}, amplification resonance circuit G(s) and feedback circuit β(s) [Fig.1].

I expresse this oscillation circuit by use the communication function, as follows.

$$Y(s) = G(s) \cdot Q(s) / [1 - \beta(s) \cdot G(s)] \qquad [2-4]$$

Expresse the closed loop propagator

$$Gf(s) = G(s) / [1 - \beta(s) \cdot G(s)] \qquad [2-5]$$

By the way, I must make up the energy loss in the circuit for oscillate a stably. For its purpose, I must continue to supply always there with the energy. However, I can take output by the circuit that without the supply of the energy continues to oscillate, if

$$\beta(s) \cdot G(s) = 1 \qquad [2-6]$$

is formed (The basics on the electronics, Shokabo Co.). This circuit steadies oscillation as the constant frequency under the limitation on the characteristic in case of the solution of 's' in [2 − 6] appears as the pure imaginary number.

Now, I operate the Laplace transform use the loop propagator. In this case, that you must be careful that Laplace operator 's' has the complex number generally, not the pure imaginary number. By the way, Laplace operator 's' takes limitation as the convergence of the expression. Therefore, we must give 's'

$$-s = +\sigma + i\omega \quad \text{or} \quad +s = -\sigma + i\omega \qquad [2-7]$$

The general circuit needs the resonance circuit to get stable oscillation but I can remove it that does not need stable. In this case, the circuit that does not explosive oscillation has limitation on the characteristic. The gain has not infinity like it. Therefore, I should make

$$\beta(s) \cdot G(s) = -(s - \sigma)^2 / \omega^2$$

$$= 1 \qquad [2-8]$$

for a solution of 's' has in the right of [2 − 7]. Above, I could have done the preparation to get the oscillation of the electronic circuit.

Then, I deliberate that use the block diagram of [Fig.2] to get a solution about oscillation of the space. I make V_{in} that enters from $\beta(s)$ to G(s) and make V_{out} that enters from G(s) to $\beta(s)$. In this case, we will call the full closed loop propagator of expression [2 - 5].

First, I will define G(s) and $\beta(s)$. I replace G(s) that is the same structure of the real space with X^2. Also, replace $\beta(s)$ that is the same structure of the imaginary space with $(iX)^2$. However, I can look $\beta(s)$ only as time that 'ic' drop off from the real space. For this reason, get

$$X^2 = -(icT)^2 \qquad [2-9]$$

because I can replace $(iX)^2$ with $(icT)^2$. Above, I get relation of

$$\beta(s) = -G(s) / c^2 \qquad [2-10]$$

And it is represented as

$$\beta(s) \cdot G(s) = -G(s) \cdot G(s) / c^2 \qquad [2-11]$$

Also, I represent [2 - 11] to

$$G(s) \cdot G(s) / c^2 = (s-\sigma)^2 / \omega^2 \qquad [2-12]$$

use [2 - 8]. Then, I get expression

$$G(s) = \pm c(s-\sigma) / \omega \qquad [2-13]$$

Now, I get

$$Gf(s) = \pm[c(s-\sigma)/\omega] / [1+(s-\sigma)^2/\omega^2]$$

$$= \pm c\omega[(s-\sigma)/((s-\sigma)^2+\omega^2)] \qquad [2-14]$$

by put [2 - 8] and [2 - 13] into [2 - 5]. I operate the reverse Laplace transform in this Gf(s). The result is as follows.

$$a = L^{-1}[Gf(s)]$$

$$= \pm c\omega L^{-1}[(s-\sigma)/((s-\sigma)^2+\omega^2)]$$

$$= \pm c\omega e^{-\sigma\tau}\cos\omega\tau \qquad [2-15]$$

Finally, I get

$$a = \pm c\,\omega\,e^{\pm\sigma\tau}\cos\omega\,\tau \qquad [2-16]$$

that consider a solution (the left side of [2 − 7]) of Laplace operator 's'. This is the elementary function of the **GAP Space theory** (GAPS).

2-(2) Extension of the elementary-function (a)

The real-space and the imaginary space have three dimensions. Therefore, I need modification of expression [2 − 16]. There have not more contents than the relation between one dimension of the real space and one dimension of the imaginry space, though. Actually, the limitation that one dimension of the imaginary space correspond to one dimension of the real space has the limitation that is correspondence on one by one treating propagator. I consider the above, must express the relation of 3 pieces of the space into the elementary function. Therefore, I get

$$a_j = \pm c\,\omega_j \exp(\pm\,\sigma_j\,\tau)\cos\omega_j\,\tau \qquad j=1,2,3 \qquad [2-17]$$

If it dose not mislead you, I simplify with omits the mark of $\pm$ in [2 − 17]. It is as follows.

$$a_j = c\,\omega_j e^{\pm\rho_j}\cos\delta_j \qquad \sigma_j\,\tau = \rho_j,\ \ \omega_j\,\tau = \delta_j \qquad [2-18]$$

Next, I will affirm that [2 − 18] is the relational expression, which was gotten when I look at the whole space from the real space. How do I look at the whole space from the imaginary space? In this case, get relational expression

$$i\,a_j = i\,c\,\omega_j e^{\pm\rho_j}\cos\delta_j \qquad [2-19]$$

Here, you remember the story that find [2 − 9]. There, I adapted it that each squared the real space and the imaginary space to the block diagram. In other words, I must treat the elementary function is same it when the real space and the imaginary space interfere in direct. I say it more kindly, the real space and the imaginary space meet in the squared condition, and therefore, the elementary function is same. This is expressed with

$$(a_j)^2 + (i\,a_j)^2 = a_j^2 - a_j^2$$

$$= 0 \qquad [2-20]$$

It has disappeared. Under present condition, whole space **H** separates into the real space and the imaginary space, but they disappear immediately and have returned original. Actually, this is the phenomenon that happens when Laplace operator 's' has the pure imaginary number. Under of the fact that the space of us exists, Laplace operator 's' has not the pure imaginary number. Is not any thought adequate to do me? Exactly. Actually, Laplace operator 's' has the complex number. It means that the complex space exists in the whole space. Do I express that there has the gap, the cmplex space like a membrane, between the real space and the imaginary space? Surely, I can catch like this that the complex number is made between the real number and the imaginary number. I take this in the elementary function is easy. I need only to put symbol 'i' of the imaginary mark in front of σ as follows.

$${}_{g}a_j = c\,\omega_j \exp(\pm i\,\sigma_j\,\tau)\cos\omega_j\,\tau \qquad [2-21]$$

Subscript g on the left of a_j is the symbol that shows the complex expression. Then, we get three kinds of the elementary functions. From the above, existing the whole space is expressed with

$$\mathbf{H}^9 = [\,\mathbf{R}^3 \mid \mathbf{G}^3 \mid \mathbf{I}^3\,] \qquad [2-22]$$

9 of the right shoulder on **H** mean that the whole space has 9 dimensions. Then, $\mathbf{G}^3$ expresses the complex space, i.e. the GAP Space. As the discussion above, we will express by three pieces of the space do not split fully and lead gently with $\mathbf{G}^3$. As for this meaning, present whole space was not exploded and the phase transition will express it a change successfully. Write it as

$$\mathbf{H} \xrightarrow{\text{phase tr}} \mathbf{H}^9 = [\,\mathbf{R}^3 \mid \mathbf{G}^3 \mid \mathbf{I}^3\,] \qquad [2-23]$$

Then, does phase transition in the space happen easily? No, it does not. Probably, our space that after experiences the phenomenon of [2 − 20] many times has been born. I will discuss later in this point.

By the way, the extension with the eiementary function is remaining. The unit dimension of a_j in [2 − 17] has acceleration $[m^1 s^{-2} rad^1]$ by ω $[rad^1 s^{-1}]$. Therefore, I suppose get the expressions of velocity and length by repeat the integration of a_j. Indeed, I get there that integrat it about τ. For exsample,

$$a^{\pm}_j = \pm c\,\omega_j \exp(\pm\sigma_j\tau)\cos\omega_j\tau \qquad [2-24]$$

leads

$$v^{+}_j = \int a^{+}_j d\tau$$

$$= c\,\omega_j \exp(+\sigma_j\tau)[\omega_j \sin\omega_j\tau + \sigma_j \cos\omega_j\tau] / (\sigma_j^2 + \omega_j^2) \qquad [2-25]$$

$$v^{-}_j = \int a^{-}_j d\tau$$

$$= c\,\omega_j \exp(-\sigma_j\tau)[\omega_j \sin\omega_j\tau - \sigma_j \cos\omega_j\tau] / (\sigma_j^2 + \omega_j^2) \qquad [2-26]$$

I omit the constant that appears with the indefinite integration. Then,

$$[\omega_j \sin\omega_j\tau + \sigma_j \cos\omega_j\tau] = \sin(\omega_j\tau + \Delta\delta_{a+}) \cdot (\sigma_j^2 + \omega_j^2)^{1/2}$$

$$\Delta\delta_{a+} = \tan^{-1}(+\sigma_j / \omega_j) \qquad [2-27]$$

$$[\omega_j \sin\omega_j\tau - \sigma_j \cos\omega_j\tau] = \sin(\omega_j\tau + \Delta\delta_{a-}) \cdot (\sigma_j^2 + \omega_j^2)^{1/2}$$

$$\Delta\delta_{a-} = \tan^{-1}(-\sigma_j / \omega_j) \qquad [2-28]$$

are formed. I gather [2 − 25] and [2 − 26] to one expression to be careful, for there not to be confusing of $\pm$, put [2 − 27] and [2 − 28] in there. Therefore, velocity $v^{\pm}_j$ can be represented as

$$v^{\pm}_j = c\,\omega_j e^{\pm\sigma_j\tau} \sin(\omega_j\tau + \Delta\delta_{a\pm}) / (\sigma_j^2 + \omega_j^2)^{1/2}$$

$$\Delta\delta_{a\pm} = \tan^{-1}(\pm\sigma_j / \omega_j) \qquad [2-29]$$

Incidentally, this sine function can be shown in the cosine function. In the same way, I can get length $r^{\pm}$ and "movement difficulty" $b^{\pm}$. But, I do not write them here.

Next, I will extend the elementary function in the complex space. By the way the exponential function has

$$\exp(\pm i\,\sigma_j\tau) = \cos\sigma_j\tau \pm i \sin\sigma$$

Actually, we cannot do the addition and the subtraction between the real number and the imaginary number in this case. In other words, I have not problem that the real number and the imaginary number are only shown in the complex expression for compose the expression. On such thinking, I integrate of $_ga_j$ in [2 − 21].

$$_gv^+_j = \int {}_ca^+_j d\tau$$

$$= c\omega_j \exp(+i\sigma_j\tau)[\omega_j \sin\omega_j\tau + i\sigma_j \cos\omega_j\tau] / (-\sigma_j^2 + \omega_j^2) \qquad [2-30]$$

$$_gv^-_j = \int {}_ca^-_j d\tau$$

$$= c\omega_j \exp(-i\sigma_j\tau)[\omega_j \sin\omega_j\tau - i\sigma_j \cos\omega_j\tau] / (\sigma_j^2 + \omega_j^2) \qquad [2-31]$$

OK, I look [2 − 32] tightly. $(-\sigma_j^2+\omega_j^2)$ appeared here. I must considere this deeply. I accept just as it for now.

3. Variables

3-(1) Meaning of ω, σ and τ

I got explession $a^{\pm}_j$ use the Laplace transform. They have varieties of phenomena in the Laplace transform and have each way of the transform that suited the phenomenon respectively. Then, those ways of the transform are lined with some theorem.

This transform to be discussing here will be concluded on the Bromwich=Wagner (B=W) theorem (Laplace transform and the operational calculus. Corona Inc.) . This theorom is composed by the B=W circle with infinite radius L. However, we do not discuss it now. We need the B=W circle only. This circle exists on the s-plane which is shown in operator s=$(\Sigma, i\Omega)$.
Also, radius L is explessed in $L = (\sigma, i\omega)$. By the way, complex expression $_ga^{\pm}_j$ has imaginary mark 'i' in front of σ_j. And then, $_ga^{\pm}_j$ has 3 dimensions which is composed of three expression. First, I must adjust dimensional quantity. For its purpose, we need three B=W circles [Fig.B=W]. Radius L of this B=W circles is represented as

$$L = (\sigma_j, i\omega_j), \qquad \sigma_j = L\cos\theta_j, \quad \omega_j = L\sin\theta_j \qquad [3-1]$$

I square this L, it has

$$L^2 = \sigma_j^2 - \omega_j^2, \qquad \because \sigma j \perp i \omega j \qquad [3-2]$$

This is the meaning of $(-\sigma_j^2 + \omega_j^2) = -(\sigma_j^2 - \omega_j^2)$ which appeared in ${}_g a^{\pm}{}_j$ [2 – 32]. It depends on this, I understand that the s-space guarantees the existence of the gap space, and a way of adopting an imginary axis in the gap space is not tied by the s-space, also it has not in the problem even if σ_j has imaginary mark 'i'.

Also, I make relation between σ_j and ω_j develop into the real space and $L^2 = \sigma_j^2 + \omega_j^2$ can be formed as $L = (\sigma j, \omega j)$. I can catch as the sphere that combination of these three circles. I call this Sub-Bromwich=Wagner sphere. Therefore, I rewrite to

$$w = (\sigma_j, \omega_j) \qquad \because \sigma_j = w \cos\theta_j, \ \omega_j = w \sin\theta_j \qquad [3-3]$$

$$w^2 = \sigma_j^2 + \omega_j^2 \qquad \because \sigma_j \perp \omega_j, \quad \omega_j = (\sigma_k + \sigma_n), \qquad j \neq k \neq n$$

$$= \sigma_j^2 + \sigma_k^2 + \sigma_n^2 \qquad \because \omega_j = (\sigma_k, \sigma_n) \qquad [3-4]$$

This is the equation of the sphere in the real space. In other words, σ_j and ω_j are formed on such relation.

By the way, I must reconsider the concept in the time for the definition of τ. Dose the time will pure physical quantity? Surely, it is the measure that must be to estimate the future. However, I cannot decide that the time dimension exists in our space by the fact that cannot return to the past. Also, we can estimate the future but cannot go to the future. In the past, we fix persistently in our memory and in the future, we build up in the present pile. How do I catch the moveing condition up in physics? I do not measure it in the passage of the time; I measure it under the variation of the momentum. The time, in this meaning, it is the measurement that is brings in to measure the variation of the motion. It is the story, which does not have a dream.

If we do not have the time dimension, the discussion of here has the possibility to become empty. It is exactly but I can excuse to have utilized it that the measurement of estimates the future as the mathematical technique successfully.

What do I must explain τ? Can I explain it is the unit elementary quantity (unity) that appears when the quantization of the momentum?

But, it has the dimension of the time. Under present condition, we seem to contradict a previous discussion. However, τ does not appear in the surface of the expression, but it exists as hide in the trigonometric function and the exponential function. The excuse is formed to have utilized time successfully as the mathematical technique about this meaning. Specifically, I make τ (or the minimum value of τ) Planck time t_{pl} will be proper. I explain this reason that has relation with radius w, later.

$$\tau = 5.390557921 \times 10^{-44} \quad [\,s^1\,] \quad \text{(Planck time)} \qquad [3-5]$$

3-(2) Extension of the elementary function (b)

I want to discuss about the elementary function any more. I immediately understand that the vector exists in each three dimensional space. Then, I find that $\omega_j \tau$ with the elementary function has the angle that is composed between each dimensional axis and the vector.

$$\mathbf{a} = (a_1, a_2, a_3)$$

$$a_j = c\,\omega_j e^{\pm \sigma_j \tau} \cos \omega_j \tau \qquad [3-6]$$

Here, I omit super-script $\pm$ on a_j. Expression [3 − 6] is the projection of the vector on each dimension. This vector is expressed with two ingredients of $\cos \omega_j \tau$ and $\sin \omega_j \tau$ on the plane [Fig.3]. Therefore, I represent the ingredient of the other to [3 − 6] as

$$a^*_j = c\,\omega_j e^{\pm \sigma_j \tau} \sin \omega_j \tau \qquad [3-7]$$

I make the vector that composed by one pair of a_j and a^*_j

$$A_j = (a_j, a^*_j) \qquad [3-8]$$

Call a^*_j the ghost of a_j. Also, represent the vector which is composed by a^*_j as

$$\mathbf{a}^* = (a^*_1, a^*_2, a^*_3) \qquad [3-9]$$

From above, I make

$$\mathbf{A} = (\mathbf{a}, \mathbf{a}^*) \qquad [3-10]$$

By the way, I look at vj which integration aj (by presumption $\omega_j \perp \sigma_j$) has

$$v_j = c\,\omega_j e^{\pm\sigma_j\tau}[\omega_j \sin\omega_j\tau \pm \sigma_j \cos\omega_j\tau] / (\sigma_j^2+\omega_j^2)$$

$$= ce^{\pm\sigma_j\tau}[\omega_j^2 \sin\omega_j\tau \pm \omega_j\sigma_j \cos\omega_j\tau] / (\sigma_j^2+\omega_j^2)$$

$$= ce^{\pm\sigma_j\tau}\,\omega_j^2 \sin\omega_j\tau / (\sigma_j^2+\omega_j^2) \qquad \because \omega_j \perp \sigma_j \qquad [3-11]$$

I make vector **a** that is the unit elementary vector. As for ingredient a_j on each dimensions are completely same size. I call it elementary ingredient a_j. Then, one **a** exists only on the diagonal line in a unit space (a unit cube). In this case, one **a** has angle Θ_e between each dimension and it.

$$\Theta_e = \cos^{-1}[(1/3)^{1/2}]$$

$$= 0.9553166182 \quad [\mathrm{rad}] \qquad (54.73561032^\circ) \qquad [3-12]$$

$$\Theta_e = \delta_1 = \delta_2 = \delta_3 \qquad [3-13]$$

(Omits proof). Actually, this is the tilt angle of electron.

4. Pair production of light velocity c with Planck's constant

4-(1) Whole space H^9

I operate the eiementary function. First, rewrite as follows

$$\omega_j\tau = w\tau\sin\theta_j, \qquad \sigma_j\tau = w\tau\cos\theta_j \qquad [4-1]$$

[3 - 12] has

$$a_j = c\, w\sin\theta_j \exp(\pm w\tau\cos\theta_j)\cos(w\tau\sin\theta_j) \qquad [4-2]$$

$${}_g a_j = c\, w\sin\theta_j \exp(\pm i\, w\tau\cos\theta_j)\cos(w\tau\sin\theta_j)$$

$$= c\, w\sin\theta_j[\cos(w\tau\cos\theta_j) \pm i\sin(w\tau\cos\theta_j)]\cos(w\tau\sin\theta_j) \qquad [4-3]$$

that I substitute [4 - 1] for the elementary function. $w\tau$ has a dimension of angle but I estimate it some constant. For now, I prepare the value from zero to an infinity in $w\tau$. Next, I want to prepare the value of $\omega_j\tau$ and θ_j. However, I cannot decide the value as $\omega_j\tau$, $w\tau$ and θ_j because there are in the subordination each other, though. Therefore, I calculate the value of θ_j based on that specify the value of $\omega_j\tau$ one by one.

$$\theta_j = \sin^{-1}(\omega_j\tau / w\tau) \qquad [4-4]$$

By the way, it has

$$\theta_j = \sin^{-1}(\Theta_e / w\tau) \qquad [4-5]$$

from $\omega_j\tau = \Theta_e$ as find in the front-chapter. Based on this, I express on [Sheet1] values that calculate a_j and ${}_ga_j$ by my computer. Incidentally, I ignored the value of c and independently existing w for this calculation.

I get a lot of interesting phenomena on this work sheet.

First, the real part in vecter ingredient ${}_ga_j$ of the gap space that increases gradually while it vibrates as θ_j heads for $\pi/2$ from zero reaches value [0.577350269cw]. It is oscillating where θ_j is close zero. The gap space was born in this way [Graph1].

The imaginary part of ${}_ga_j$ is reversed with the phase of the real part and it increases gradually while oscillation same as the real part but it disappeares on the point of $\theta_j = \pi/2$ [Graph2].

[Graph5] shows the subordination of the real part and the imaginary part in ${}_ga_j$. I find that ${}_ga_j$ draw the spiral turn around central axis θ even if I do not make 3-D graph using the software which the graph function is excellent.

Next, the side of e^+ of real space vector ingredient a_j has zero by $\theta_j=0$. However, the value of it rises approximately to the infinity only θ_j moves minimal. Then, it decreases rapidly as θ_j increases and converges on value [0.577350269 cw] in $\theta_j = \pi/2$. I seem this phenomenon with the Big Bang as you say [Graph3].

The side of e^- in a_j has zero at $\theta_j=0$ is the same as e^+. However, e^- settles in value [0.577350269cw] without increasing rapidly then θ_j is heading for $\pi/2$ [Graph4].

Two phenomena are progressing at the same time even if I take only real space $\mathbf{R}^3$ in this way. This is the point that is different from the Big Bang theory.

The appearance of imaginary space vector ingredient ia_j is the same as a_j.

The Big Bang happened on the side of the imaginary space, too. But, here, I do not call it the Big Bang. Persistently, I take these all phenomena with one thing, and call it the phase transition of whole space **H**. After this, $\mathbf{H}^9$ was born, as you know.

4-(2) Pair production of c with ℏ

Actually, I calculated the eiementary function that gave not only $\omega_j \tau = \Theta_e$ but also various value to $\omega_j \tau$ in the pre-section. In this reason, I wanted a hint that decide value of radius w in the B=W circle. Casually, I found a hint that value of light velocity c in the vicinity of $w\tau = 48.9$ while repeate calculation many times.

I repeated trial and errors that use my computer at 1 year. If I calculate it on a paper that suppose take 30 years over. I appreciate and surprise that the ability of the computer was improved within several years. Actually, the computer that I had before was useless because it was one in the Stone Age.

Then, I search for the value of c use [4 − 2].

$$a^{\pm}{}_j = c\,\omega_j\ e^{\pm\rho_j}\ \cos\delta_j$$

$$= c\ w\sin\theta_j\ \exp(\pm w\tau\cos\theta_j)\cos(w\tau\sin\theta_j) \qquad [4-2]$$

You pay attention to the way of taking a variable here like the pre-section. But, here, I give $\omega_j \tau = \delta_j$ from $\pi/2$ to 0, first. After that, I find the value of θ_j from $\theta_j = \sin^{-1}(\omega_j \tau / w\tau)$. Now I suppose, value $w\tau$ has "48.9" that I found it before. After that, I search $w\tau$ at vicinity in "48.9". I express the calculation result in Case①, Case②, Case③.

We know the following value.

$$c = 299792458 \quad [m^1 s^{-1}], \qquad \hbar = 1.054571596 \times 10^{-34} \quad [J^1 s^1]$$

$$\hbar / c = 3.517672202 \times 10^{-43} \quad [J^1 m^{-1} s^2]$$

The result should be surprised as you can see. I enumerate the most important part of each case as follows.

Case① [Condition①] $w\tau = 48.87668$, $\delta_j = 0.0000000000553261063\,\pi/2$

$\theta_j = 1.77807\times 10^{-13}$

[Result①] $a^+_j = 299792458.2\ c\,w$, $a^-_j = 1.05457\times 10^{-34}\ c\,w$

$a^-_j / a^+_j = 3.51767\times 10^{-43}$

Case② [Condition②] $w\tau = 48.886016$, $\delta_j = \Theta_e$

$\theta_j = 0.01954296$

[Result②] $a^+_j = 1.90228\times 10^{+19}\ c\,w$, $a^-_j = 6.6916\times 10^{-24}\ c\,w$

$a^-_j / a^+_j = 3.51767\times 10^{-43}$

Case③ [Condition③] $w\tau = 48.901915$, $\delta_j = 0.999999999996476\,\pi/2$

$\theta_j = 0.032126893$

[Result③] $a^+_j = 299801584.4\ c\,w$, $a^-_j = 1.0546\times 10^{-34}\ c\,w$

$a^-_j / a^+_j = 3.51767\times 10^{-43}$

I cannot lead the result out only these values in here by the ability of my computer. However, it excellently found the value of light velocity c in the side of a^+_j. In addition to it, found the value of Planck's constant ħ in the side of a^-_j in the identical condition. The proper-ness of the gap space theory is lined by this pair production of c with ħ.

However, they have ones that must be reconsidered. I did not considere the value of cw in there, also value c and ħ are not same as the actual value in Case②.

First, I describe c and ħ. Actually, these "values" are only the value that was given under some dimension by human measurement and they are not absolute at physically. As for the meaning, I may decide that they have c=1, ħ=1 and actually, you have done this operate frequently. In this way, I suppose that c and ħ are merely "symbol". Actually, ratio ħ/c is most important on the physics. Therefore, I can understand that discrepancy of the values in Case② are not big problems. Also, ratio $a^-_j/a^+_j = \hbar/c$ is formed that w has whatever values. I get the limited expression as follows that rewrite the elementary function from above.

$$a^+_j = c\,\omega_j\, e^{+\rho_j} \cos\delta_j, \qquad \varepsilon^-_j = \hbar\,\omega_j\, e^{-\rho_j} \cos\delta_j \qquad [4-6]$$

In the above considering, I ignored the unit dimension of c and ħ.

Therefore, I expresse the side of '+' is velocity v^{+}_{j}, also the side of '—' is angular momentum $\hbar^{-}_{j}$ in [3－11].

$$v^{+}_{j} = c\,\omega_j^2 e^{+\rho_j} \cos\delta_j / (\sigma_j^2+\omega_j^2) \qquad [4-7]$$

$$\hbar^{-}_{j} = \hbar\,\omega_j^2 e^{-\rho_j} \cos\delta_j / (\sigma_j^2+\omega_j^2) \qquad [4-8]$$

I can rewrit these expressiones from the reason as

$$\omega_j = w \sin\theta_j, \quad \sigma_j = w\cos\theta_j, \quad \therefore (\sigma_j^2+\omega_j^2) = w^2 \qquad [4-9]$$

to

$$v^{+}_{j} = c \sin^2\theta_j\, e^{+\rho_j} \cos\delta_j \qquad [4-10]$$

$$\hbar^{-}_{j} = \hbar \sin^2\theta_j\, e^{-\rho_j} \cos\delta_j \qquad [4-11]$$

Now, we can calculate in [4－10], [4－11].
These results are in Case④, Case⑤, Case⑥ as follows.

Case④ [Condition④] $w\tau = 48.87668$, $\delta_j = 0.00001312066853\,\pi/2$

$\theta_j = 4.21671\times10^{-7}$

[Result④] $v^{+}_{j} = 299792458\,c$, $\hbar^{-}_{j} = 1.05457\times10^{-34}\,\hbar$

$\hbar^{-}_{j}/v^{+}_{j} = 3.51767\times10^{-43}$

Case⑤ [Condition⑤] $w\tau = 48.886015$, $\delta_j = \Theta_e$

$\theta_j = 0.01954296$

[Result⑤] $v^{+}_{j} = 3.71738\times10^{+17}\,c$, $\hbar^{-}_{j} = 1.30765\times10^{-25}\,\hbar$

$\hbar^{-}_{j}/v^{+}_{j} = 3.51767\times10^{-43}$

Case⑥ [Condition⑥] $w\tau = 48.901915$, $\delta_j = 0.999999999890292\,\pi/2$

$\theta_j = 0.032126893$

[Result⑥] $v^{+}_{j} = 299791839.4\,c$, $\hbar^{-}_{j} = 1.05457\times10^{-34}\,\hbar$

$\hbar^{-}_{j}/v^{+}_{j} = 3.51767\times10^{-43}$

Case② and Case⑤ have the condition

$$\delta_j = \Theta_e \qquad (j=1,2,3) \qquad [3-13]$$

I can rewrite [3 − 11] to

$$R = [\, c_{(+)} , \hbar_{(-)}] \qquad [4-12]$$

In this case, the elementary function is expressed as

$$f(\theta_j) = R \sin^2\theta_j \ e^{\pm\rho_j} \ \cos\delta_j$$

$$= (c \sin^2\theta_j \ e^{+\rho_j} \ \cos\delta_j , \quad \hbar \sin^2\theta_j \ e^{-\rho_j} \ \cos\delta_j) \qquad [4-13]$$

I remak only $e^{+\rho_j}$ and $e^{-\rho_j}$, because the important one is ratio $\hbar/c$. In this case, I call $e^{+\rho_j}$ the kernel of c and call $e^{-\rho_j}$ the kernel of $\hbar$. These results are as follows (Case⑦, Case⑧, Case⑧).

Case⑦ [Condition⑦] $w\tau = 48.87668$, $\delta_j = 0.00000000000553261063\,\pi/2$

$\theta_j = 1.77807\times10^{-13}$

[Result⑦] $c\,e^{+\rho_j} = 1.68606\times10^{+21}\,c$, $\hbar\,e^{-\rho_j} = 5.931\times10^{-22}\ \hbar$

$e^{-\rho_j}/e^{+\rho_j} = 3.51767\times10^{-43}$

Case⑧ [Condition⑧] $w\tau = 48.886015$, $\delta_j = \Theta_e$

$\theta_j = 0.01954296$

[Result⑧] $c\,e^{+\rho_j} = 1.68606\times10^{+21}\,c$, $\hbar\,e^{-\rho_j} = 5.931\times10^{-22}\ \hbar$

$e^{-\rho_j}/e^{+\rho_j} = 3.51767\times10^{-43}$

Case⑨ [Condition⑨] $w\tau = 48.901915$, $\delta_j = 0.999999999890292\,\pi/2$

$\theta_j = 0.032126893$

[Result⑨] $c\,e^{+\rho_j} = 1.68606\times10^{+21}\,c$, $\hbar\,e^{-\rho_j} = 5.93099\times10^{-22}\ \hbar$

$e^{-\rho_j}/e^{+\rho_j} = 3.51767\times10^{-43}$

Therefore, I can lead

$$c\,e^{+\rho_j} = 1.68606\times10^{+21}\,c , \qquad \hbar\,e^{-\rho_j} = 5.931\times10^{-22}\ \hbar$$

$$e^{-\rho_j}/e^{+\rho_j} = 3.51767\times10^{-43} \qquad e^{-\rho_j}\cdot e^{+\rho_j} = 1$$

anywhere in condition of $[0 \leqq \delta_j \leqq \pi / 2]$ and $[48.87668 \leqq w\tau \leqq 48.901915]$.

By the way, it is insufficient that $\hbar$ with value is only gotten. Justly, I must consider on the theory which leads $\hbar$. Therefore, I lead $\hbar$ by the technique which is the same as the elementary function found in the metric space. But, I must replace space **X** that in the equivalent circuit to the moment of inertia Ψ [Fig.4]. The feedback circuit has "i $\hbar$ t". In this way, the elementary function is gotten as follows.

$$\varepsilon_j = \hbar\omega_j e^{-\sigma_j \tau} \cos\omega_j \tau \qquad [4-14]$$

Then, integrated it is the angular momentum as follows.

$$\hbar_j = \hbar\omega_j e^{-\sigma_j \tau} \sin(\omega_j \tau + \Delta\delta_{a-}) / (\sigma_j^2 + \omega_j^2)^{1/2}$$

$$\Delta\delta_{a-} = \tan^{-1}(-\sigma_j / \omega_j) \qquad [4-15]$$

[4 - 8] is the vector expression of [4 - 15].

$$\hbar^-_j = \hbar\omega_j^2 e^{-\rho_j} \cos\delta_j / (\sigma_j^2 + \omega_j^2) \qquad [4-8]$$

4-(3) Collect the expressions

I collect all expressions are as follows.

The scalar expressions in real space $\mathbf{R}^3$.

$$a^+_j = c\omega_j \exp(+\sigma_j \tau) \cos\omega_j \tau \qquad [4-16]$$

$$v^+_j = c\omega_j e^{+\sigma_j \tau} \sin(\omega_j \tau + \Delta\delta_{a\pm}) / (\sigma_j^2 + \omega_j^2)^{1/2}$$

$$\Delta\delta_{a+} = \tan^{-1}](+\sigma_j / \omega_j) \qquad [4-17]$$

$$r^+_j = c\omega_j e^{+\sigma_j \tau} [2\omega_j \sigma_j \sin\omega_j \tau - (\sigma_j^2 - \omega_j^2) \cos\omega_j \tau] / (\sigma_j^2 + \omega_j^2)^2$$

$$= c\omega_j e^{+\sigma_j \tau} \cos(\omega_j \tau - \Delta\delta_{r+}) / (\sigma_j^2 + \omega_j^2)$$

$$\Delta\delta_{r+} = \tan^{-1}(-2\omega_j \sigma_j / (\sigma_j^2 - \omega_j^2)) \qquad [4-18]$$

$$b^+_j = c\omega_j e^{+\sigma_j \tau} [\omega_j(\omega_j^2 - 3\sigma_j^2) \sin\omega_j \tau + \sigma_j(3\omega_j^2 - \sigma_j^2) \cos\omega_j \tau] / (\sigma_j^2 + \omega_j^2)^3$$

$$= c\omega_j e^{+\sigma_j \tau} \sin(\omega_j \tau + \Delta\delta_{b+}) / (\sigma_j^2 + \omega_j^2)^{3/2}$$

$$\varDelta\delta_{b+} = \tan^{-1}[+(3\omega_j^2\sigma_j - \sigma_j^3)/(\omega_j^3 - 3\omega_j\sigma_j^2)] \qquad [4-19]$$

Incidentally, we omitted a symbol ± before but the positive and negative solutions exist in these expressions.

The vector expressions in real space $\mathbf{R}^3$. The expressions which have super-script "＊" are ghosts.

$$a_j = c\omega_j\ e^{+\rho_j}\ \cos\delta_j$$

$$a^*_j = c\omega_j\ e^{+\rho_j}\ \sin\delta_j \qquad [4-20]$$

$$v_j = c\omega_j^2 e^{+\rho_j}\ \cos\delta_j/(\sigma_j^2+\omega_j^2)$$

$$v^*_j = c\omega_j^2 e^{+\rho_j}\ \sin\delta_j/(\sigma_j^2+\omega_j^2) \qquad [4-21]$$

$$r_j = c\omega_j^3 e^{+\rho_j}\ \cos\delta_j/(\sigma_j^2+\omega_j^2)^2$$

$$r^*_j = c\omega_j^3 e^{+\rho_j}\ \sin\delta_j/(\sigma_j^2+\omega_j^2)^2 \qquad [4-22]$$

$$b_j = c\omega_j^4 e^{+\rho_j}\ \cos\delta_j/(\sigma_j^2+\omega_j^2)^3$$

$$b^*_j = c\omega_j^4 e^{+\rho_j}\ \sin\delta_j/(\sigma_j^2+\omega_j^2)^3 \qquad [4-23]$$

I omit the expressions in imaginaiy space $\mathbf{I}^3$ because put only imaginary symbol mark 'i' to the head of these expressions in $\mathbf{R}^3$, here.

Below, I list the elementary functions that were gotten from the equivalent circuit of the moment of inertia.

The scalar expressions in Real-Inertia-Moment-Space ${}_{R}\Psi_3$.

$$\varepsilon^-_j = \hbar\,\omega_j e^{-\sigma_j\tau}\cos\omega_j\tau \qquad [4-24]$$

$$\hbar^-_j = \hbar\,\omega_j e^{-\sigma_j\tau}\ \sin(\omega_j\tau + \varDelta\delta_{a-})/(\sigma_j^2+\omega_j^2)^{1/2}$$

$$\varDelta\delta_{a-} = \tan^{-1}(-\sigma_j/\omega_j) \qquad [4-25]$$

$$\phi^-_j = \hbar\,\omega_j e^{-\sigma_j\tau}\ \cos(\omega_j\tau - \varDelta\delta_{r-})/(\sigma_j^2+\omega_j^2)$$

$$\varDelta\delta_{r-} = \tan^{-1}(+2\omega_j\sigma_j/(\sigma_j^2-\omega_j^2)). \qquad [4-26]$$

$$\chi^-_j = \hbar\,\omega_j e^{-\sigma_j\tau}\ \sin(\omega_j\tau + \varDelta\delta_{b-})/(\sigma_j^2+\omega_j^2)^{3/2}$$

$$\varDelta\delta_{b-} = \tan^{-1}[-(3\omega_j^2\sigma_j - \sigma_j^3)/(\omega_j^3 - 3\omega_j\sigma_j^2)] \qquad [4-27]$$

The vector expressions in real-inertia-moment-space ${}_R\Psi_3$.

$$\varepsilon_j = \hbar\omega_j\ e^{-\rho_j}\ \cos\delta_j$$

$$\varepsilon^*_j = \hbar\omega_j\ e^{-\rho_j}\ \sin\delta_j \qquad [4-28]$$

$$\hbar_j = \hbar\omega_j^2 e^{-\rho_j}\ \cos\delta_j/(\sigma_j^2+\omega_j^2)$$

$$\hbar^*_j = \hbar\omega_j^2 e^{-\rho_j}\ \sin\delta_j/(\sigma_j^2+\omega_j^2) \qquad [4-29]$$

$$\phi_j = \hbar\omega_j^3 e^{-\rho_j}\ \cos\delta_j/(\sigma_j^2+\omega_j^2)^2$$

$$\phi^*_j = \hbar\omega_j^3 e^{-\rho_j}\ \sin\delta_j/(\sigma_j^2+\omega_j^2)^2 \qquad [4-30]$$

$$\chi_j = \hbar\omega_j^4 e^{-\rho_j}\ \cos\delta_j/(\sigma_j^2+\omega_j^2)^3$$

$$\chi^*_j = \hbar\omega_j^4 e^{-\rho_j}\ \sin\delta_j/(\sigma_j^2+\omega_j^2)^3 \qquad [4-31]$$

I omit the expression in Imaginary-Inertia-Moment-Space ${}_I\Psi_3$ because put only imaginary symbol mark 'i' to the head of these expressions in ${}_R\Psi_3$.

They have a lot of substances.

① The vector expression of ε_j has the "moment of force". Scalar expression ε_j has "energy".

② Vector expression $\hbar_j$ has the "angular momentum". Scalar expression $\hbar_j$ has the "Planck's constant".

③ Vector expression ϕ_j has the "moment of inertia". As the scalar quantity, it is unclear, now.

④ χ_j is unclear regrettably with either.

Actually, the elementary function in gap space $\mathbf{G}^3$ is same as the elementary function in Gap-Inertia-Moment-Space ${}_G\Psi_3$ completely. In this reason is consequential because all function expresse by one phase transition if I may explan the equivalent circuit whatever. Therefore, I use

$$R = [\,c_{(+)}\,,\hbar_{(-)}] \qquad [4-32]$$

These scalar expressions are as follows. However, you will be careful, that there simple expressions are in the side of e^{-} only.

$${}_{g}M^{\pm}{}_{j} = R\omega_{j}e^{\pm i\sigma_{j}\tau}\cos\omega_{j}\tau \qquad [4-33]$$

$${}_{g}H^{\pm}{}_{j} = R\omega_{j}e^{\pm i\sigma_{j}\tau}[\omega_{j}\sin\omega_{j}\tau \pm i\sigma_{j}\cos\omega_{j}\tau]/(\sigma_{j}^{2} \mp \omega_{j}^{2})$$

$${}_{g}H^{-}{}_{j} = R\omega_{j}e^{-i\sigma_{j}\tau}\sin(\omega_{j}\tau + \Delta\delta_{a-})/(\sigma_{j}^{2} + \omega_{j}^{2})^{1/2}$$

$$\Delta\delta_{a-} = \tan^{-1}(-i\sigma_{j}/\omega_{j}) \qquad [4-34]$$

$${}_{g}F^{\pm}{}_{j} = R\omega_{j}e^{\pm i\sigma_{j}\tau}[(\sigma_{j}^{2}+\omega_{j}^{2})\cos\omega_{j}\tau \mp i\,2\omega_{j}\sigma_{j}\sin\omega_{j}\tau]/(\sigma_{j}^{2} \mp \omega_{j}^{2})^{2}$$

$${}_{g}F^{-}{}_{j} = R\omega_{j}e^{-i\sigma_{j}\tau}\cos(\omega_{j}\tau - \Delta\delta_{r-})/(\sigma_{j}^{2} + \omega_{j}^{2})$$

$$\Delta\delta_{r-} = \tan^{-1}(i2\omega_{j}\sigma_{j}/(\sigma_{j}^{2}+\omega_{j}^{2})) \qquad [4-35]$$

$${}_{g}B^{\pm}{}_{j} = R\omega_{j}e^{\pm i\sigma_{j}\tau}[\omega_{j}(\omega_{j}^{2}+3\sigma_{j}^{2})\sin\omega_{j}\tau \pm i\sigma_{j}(3\omega_{j}^{2}+\sigma_{j}^{2})\cos\omega_{j}\tau]$$
$$/(\sigma_{j}^{2} \mp \omega_{j}^{2})^{3}$$

$${}_{g}B^{-}{}_{j} = R\omega_{j}e^{-i\sigma_{j}\tau}\sin(\omega_{j}\tau + \Delta\delta_{b-})/(\sigma_{j}^{2} + \omega_{j}^{2})^{3/2}$$

$$\Delta\delta_{b-} = \tan^{-1}[-i(3\omega_{j}^{2}\sigma_{j} + \sigma_{j}^{3})/(\omega_{j}^{3} + 3\omega_{j}\sigma_{j}^{2})] \qquad [4-36]$$

The vector expressions are as follows.

$${}_{g}M_{j} = R\omega_{j}\ e^{\pm i\rho_{j}}\ \cos\delta_{j}$$

$${}_{g}M^{*}{}_{j} = R\omega_{j}\ e^{\pm i\sigma_{j}}\ \sin\delta_{j} \qquad [4-37]$$

$${}_{g}H_{j} = R\omega_{j}^{2}e^{\pm i\rho_{j}}\ \cos\delta_{j}/(\sigma_{j}^{2} \mp \omega_{j}^{2})$$

$${}_{g}H^{*}{}_{j} = R\omega_{j}^{2}e^{\pm i\rho_{j}}\ \sin\delta_{j}/(\sigma_{j}^{2} \mp \omega_{j}^{2}) \qquad [4-38]$$

$${}_{g}F_{j} = R\omega_{j}^{3}e^{\pm i\rho_{j}}\ \cos\delta_{j}/(\sigma_{j}^{2} \mp \omega_{j}^{2})^{2}$$

$${}_{g}F^{*}{}_{j} = R\omega_{j}^{3}e^{\pm i\rho_{j}}\ \sin\delta_{j}/(\sigma_{j}^{2} \mp \omega_{j}^{2})^{2} \qquad [4-39]$$

$${}_{g}B_{j} = R\omega_{j}^{4}e^{\pm i\rho_{j}}\ \cos\delta_{j}/(\sigma_{j}^{2} \mp \omega_{j}^{2})^{3}$$

$${}_{g}B^{*}{}_{j} = R\omega_{j}^{4}e^{\pm i\rho_{j}}\ \sin\delta_{j}/(\sigma_{j}^{2} \mp \omega_{j}^{2})^{3} \qquad [4-40]$$

I omit the expressions in imaginary-inertia-moment-space ${}_{I}\Psi_{3}$ because put only imaginary symbol mark 'i' to the head of these expressions in ${}_{R}\Psi_{3}$.

In this chapter, pair production of c with ħ were described by the GAPS theory.

5. Curvature of the space

5-(1) Curvature Φ of the whole space

In the front-chapter, we got

$$48.87668 \leqq w\tau \leqq 48.901915 \quad [\mathrm{rad}^{1}] \qquad [5-1]$$

Specifically, it is [$w\tau = 48.886015$] in condition [$\sigma_{j} = \Theta_{e}$]. Then we assume that τ has Planck time, so radius w of the B=W circle has

$$w = 9.068822878 \times 10^{+44} \quad [\mathrm{rad}^{1}\,\mathrm{s}^{-1}] \qquad [5-2]$$

If this value is permissible mathematically as infinity category, the Laplace transform is formed in this case on the B=W theory. Curvature Φ has

$$\Phi = 1 / w$$

$$= 1.10267894 \times 10^{-45} \quad [\mathrm{rad}^{-1}\,\mathrm{s}^{1}] \qquad [5-3]$$

by this w. However, the unit dimension of w has angular velocity.

Properly, this radius w that is expressed by the angle same as the radius of the Sub-B=W sphere in the whole space. It depends, I can say that this Angular-Space has curvature Φ. In this meaning, the angular ingredient with the vector quantity that we gave earlier is on the curvilinear coordinate system. Incidentally, the metric space which can be seen is on the orthogonal coordinate system but there has the interesting phenomenon by the angular space has the curvature. For details, I will describe later.

5-(2) Micro-angular $\varDelta\delta_{j}$ and the motion of precession

I assume tangent x_{j} which is touch on the sub-B=W circle has radius w. I make unit vector **x** which gose out from the point of contact touch on this circle and x_j, also, this x and the circle make angular ϕ. Now, I examine this ϕ. Therefore, I give them some symbols like [Fig.5]. I get

$$\theta_n = \tan^{-1}(\cot\theta) \qquad [5-4]$$

$$\phi' = \tan^{-1}[(1-\cos\theta)/\sin\theta] \qquad [5-5]$$

I make $\Delta\theta$ in the case of θ has approximately zero, get

$$\phi = \lim_{(\theta\to 0)} \phi'$$

$$= \tan^{-1}[(1-\cos\Delta\theta)/\sin\Delta\theta] \qquad [5-6]$$

θ_n has the complementary angle of θ. From the above, it has the phase ingredient

$$\Delta\delta_a = \tan^{-1}(\sigma_j/\omega_j)$$

$$= \theta_n \qquad (\theta_n + \theta = \pi/2) \qquad [5-7]$$

in scalar expression v_j or so, of the elementary function.

Also,

$$\phi' = \theta/2 \qquad [5-8]$$

is proofed in the easy calculation. I get the limitation, as follows.

$$\phi \fallingdotseq \Delta\theta/2 \qquad [5-9]$$

(It omits proof). But, it is difficult that I evaluat proper ϕ as this.

Can I get this value of ϕ on another side? Though, I must replace in $\mathfrak{x}$ which has curvature Φ with vector **x** which exists there because the sub-B=W circle has curvature Φ. In this meaning, ϕ is the tilt angle which is accomplished by the true straight line and $\mathfrak{x}$. By the way, I cannot get ϕ directly because the size of $\mathfrak{x}$ is unclear. Therefore, I try calculation once again in the value of θ. Actually, I caught eyes the value of c by chance while was examining this. I get $\Delta\theta \fallingdotseq 1.77807\times10^{-13}$ in [Case①] when chose θ in this process. Put it in my mind, I get

$$\Delta\theta \fallingdotseq 1.95417\times10^{-16} \qquad [5-10]$$

as I impose the severe condition “give $\varDelta\theta$ the maximum value at $a^{\pm}{}_j$ in [case ②] does not varies by vary θ”. Then, I get the maximum limit value from [5－9].

$$\phi \lessapprox 9.77085\times10^{-17} \qquad [5-11]$$

I develop this idea into the whole space. Properly, the vector has the curvature on it because the whole space has the curvature. In this case, I make **r** that has a true straight line vector and make я that has the curvature of the vector. This я has the minimal tilt angle which is limited by $\varDelta\theta$ and ϕ compared with **r**. The angular of **r** is $\delta_j = \Theta_e$ now, so the angular of я is expressed with

$$\delta_j = \Theta_e + \phi \qquad [5-12]$$

However, you must be careful that this calculation $\Theta_e + \phi$ is not a simple addition. I describe that δ_1, δ_2 and δ_3 are in the subordination each other only here.

$$\cos\delta_j = \sin\delta_n \cos[\sin^{-1}(\cos\delta_k / \sin\delta_n)]$$

(the cycle of the order is j→k→n) [5 - 13]

I assume that this я is spinning. Then, unit vector я is doing the motion of precession in the turn of **r** at tilt ϕ. In case of macroscopic [Fig.6(a)] can be seen overlap я and **r**. Also, in the case of microscopic [Fig.6(b)] expresses the motion of precession. In the future, I describe this point in detail.

5―(3) Relation in each space

I examined how dose whole space $\mathbf{H}^9$ appear in 4―(1). Here, examine relation between $\mathbf{R}^3$, $\mathbf{G}^3$and $\mathbf{I}^3$ in detail.

I make the equivalent circuit in the metric space how I applied $\mathbf{X}^2$ to the amplification circuit and applied $(\mathrm{i}\mathbf{X})^2 = (\mathrm{ic}\mathbf{T})^2$ to the feedback circuit at the electronic circuit. Therefore, I examine the relation in each space at square

$${}_{r}M_j = R\omega_j\ e^{\pm\rho_j}\ \cos\delta_j, \qquad {}_{g}M_j = R\omega_j\ e^{\pm i\rho_j}\ \cos\delta_j$$

$${}_{i}M_j = iR\omega_j\ e^{\pm\rho_j}\ \cos\delta_j \qquad [5-14]$$

I make the subscript that 'r' has the real, 'g' has the gap and 'i' has the imaginary space of the left on each expression. Here, get them as follows.

$$ {}_{r}M_j^2 = R^2\omega_j^2\ e^{\pm 2\rho_j}\ \cos^2\delta_j\ , \qquad {}_{g}M_j^2 = R^2\omega_j^2\ e^{\pm i2\rho_j}\ \cos^2\delta_j $$

$$ {}_{i}M_j^2 = -R^2\omega_j^2\ e^{\pm 2\rho_j}\ \cos^2\delta_j \qquad [5-15] $$

The positive negative reverses of ${}_{r}M_j^2$ and ${}_{i}M_j^2$, except θ_j is zero. This is the logical reason of the anomalous value of particle and antiparticle. I mean, antiparticle exists in the imaginary space and does not exist regularly in the real space.

By the way, you will pay attention to $e^{\pm 2\rho_j}$ and $e^{\pm i2\rho_j}$. In case of θ_j is $\pi/2$, I get

$$ {}_{r}e^{\pm 2\rho_j} = 1\ , \qquad {}_{g}e^{\pm i2\rho_j} = 1\ , \qquad (\theta_j = \pi/2) \qquad [5-16] $$

I can catch the 2nd phase transition point in the whole space. In this case, the real space correspond as the gap space in substance, because θ_j does not become above $\pi/2$. Refer to [Sheet 1]. I say another word; the gap space is pasted up to the real space like a membrane. I got this result that saw them from the real space. I can say that the imaginary space correspond as the gap space by the positive negative reverses of ${}_{r}M_j^2$ and ${}_{i}M_j^2$ when saw them from the imaginary space. After this, whole space $\mathbf{H}^9$ became steady state.

I observe the phase transition of the whole space as pair creation of particle and antiparticle, at presentry. However, they are not stable because the gap space does not exist in there. Then, they have pair extinction immediately. In other words, the whole space that after the phase transition disappeare before grow at almost all cases. I expresse them with

$$ \mathbf{H} \xrightarrow{\text{phase tr}} \mathbf{H}^6 = [\,\mathbf{R}^3 \mid \mathbf{I}^3\,] \xrightarrow{\text{ixtinction}} \mathbf{H} \qquad [5-17] $$

I must describe another one. It is why did I discuss that use the ingredients without the vectors for examine the relation in the space. This reason is obvious in the way of find the elementary function. In there, they treated every pair of dimension. Therefore, I pick each ingredient up persistently and discuss the relation. After that, I expresse the whole space by combine three ingredients. The vector expression has a little irregular in this process. I discuss it in the following chapter.

I get the result as follows.

$$\mathbf{H} \xrightarrow{\text{phase tr}} \mathbf{H}^9 = [\,\mathbf{R}^3 \mid \mathbf{G}^3 \mid \mathbf{I}^3\,] \qquad [5-18]$$

6. Quantum operator c-ℏ

6-(1) Calculation of V and Ħ

Whole-space $\mathbf{H}^9$ was determined in the front-chapter. From now, we discuss to have restricted into the real-space. Then, I extract the part of the vector display that was set before.

$$\mathbf{V} = (\mathbf{v}, \mathbf{v}^*) \qquad \mathrm{V}_j = (\mathrm{v}_j, \mathrm{v}^*_j)$$

$$\mathbf{v} = (\mathrm{v}_1, \mathrm{v}_2, \mathrm{v}_3) \qquad \mathrm{v}_j = c \sin^2\theta_j \; e^{+\rho_j} \; \cos\delta_j$$

$$\mathbf{v}^* = (\mathrm{v}^*_1, \mathrm{v}^*_2, \mathrm{v}^*_3) \qquad \mathrm{v}^*_j = c \sin^2\theta_j \; e^{+\rho_j} \; \cos\delta_j \qquad [6-1]$$

And then,

$$Ħ = (\hbar, \hbar^*) \qquad Ħ_j = (\hbar_j, \hbar^*_j)$$

$$\hbar = (\hbar_1, \hbar_2, \hbar_3) \qquad \hbar_j = \hbar \sin^2\theta_j \, e^{-\rho_j} \; \cos\delta_j$$

$$\hbar^* = (\hbar^*_1, \hbar^*_2, \hbar^*_3) \qquad \hbar^*_j = \hbar \sin^2\theta_j \; e^{-\rho_j} \; \sin\delta_j \qquad [6-2]$$

The others expressed in the same way.

I specifically pursue substance that these expressions have. For example, ingredient a_j is the solution which was gotten from the B=W circle of j-th and $\cos\delta_j$ expresses a ingredient on some dimension by there but the case of carrying in a_j to real space $\mathbf{R}^3$, think that a_j one expresses the size. In other words, they have ingredient of vector **a** on the composition but fundamentally, they have independent size. Therefore, I do not say only $\cos\delta_j$ is j ingredient of **a**. Expression

$$e^{\pm\rho_j} \text{Л}_j = \sin^2\theta_j \; e^{\pm\rho_j} \; \cos\delta_j \qquad [6-3]$$

is j ingredient of **a**.　I call

$$e^{\pm\rho}{}_j \text{л}^*{}_j = \sin^2\theta_j \; e^{\pm\rho}{}_j \; \sin\delta_j \qquad [6-4]$$

a ghost in that reason.

Based on the above, I operate the scalar product of V and Ħ.

$$\mathrm{V} \cdot \text{Ħ} = (\mathrm{v}, \mathrm{v}^*)(\hbar, \hbar^*)$$

$$= \mathrm{v}\hbar + \mathrm{v}\hbar^* + \mathrm{v}^*\hbar + \mathrm{v}^*\hbar^* \qquad [6-5]$$

Then, calculate this everypart.

$$\mathrm{v}\hbar = c\hbar\,(\sin^2\theta\, e^{+\rho}\cos\delta)\,(\sin^2\theta\, e^{-\rho}\cos\delta)$$

$\downarrow \leftarrow$ ①　$j \perp k \perp n$

$\downarrow \leftarrow$ ②　$(\sin^2\theta_j\, e^{+\rho}{}_j\; \cos\delta_j)(\sin^2\theta_k\, e^{-\rho}{}_k\; \cos\delta_k) = 0$

$$= c\hbar\,[\,\Sigma_{(j=1,2,3)} \sin^4\theta_j \cos^2\delta_j\,] \qquad [6-6]$$

$$\mathrm{v}\hbar^* = c\hbar\,(\sin^2\theta\, e^{+\rho}\cos\delta)\,(\sin^2\theta\, e^{-\rho}\sin\delta)$$

$\downarrow \leftarrow$ ③　$(\sin^2\theta_j\, e^{\pm\rho}{}_j\; \sin\delta_j) = -[(\sin^2\theta_k\, e^{\pm\rho}{}_k\; \cos\delta_k),$

$\downarrow$　　　　　　　　　　　　　　　　　　$(\sin^2\theta_n\, e^{\pm\rho}{}_n \cos\delta_k)]$

$$= -2\,c\hbar\,[\,\Sigma_{(j=1,2,3)} \sin^4\theta_j\; \cos^2\delta_j\,] \qquad [6-7]$$

$$\mathrm{v}^*\hbar = c\hbar\,(\sin^2\theta\, e^{+\rho}\sin\delta)\,(\sin^2\theta\, e^{-\rho}\cos\delta)$$

$$= -2\,c\hbar\,[\,\Sigma_{(j=1,2,3)} \sin^4\theta_j \cos^2\delta_j\,] \qquad [6-8]$$

$$\mathrm{v}^*\hbar^* = c\hbar\,(\sin^2\theta\, e^{+\rho}\sin\delta)\,(\sin^2\theta\, e^{-\rho}\sin\delta)$$

$$= 4\,c\hbar\,[\,\Sigma_{(j=1,2,3)} \sin^4\theta_j \cos^2\delta_j\,] \qquad [6-9]$$

I get

$$\mathrm{V} \cdot \text{Ħ} = c\hbar\,[\,\Sigma_{(j=1,2,3)} \sin^4\theta_j \cos^2\delta_j\,] \qquad [6-10]$$

that the summation from [6－4] to [6－7].

Next, I operate the vector product of V and Ħ.　Generally, it is expressed with

$$V \times Ħ = (v, v^*) \times (ħ, ħ^*)$$

$$\downarrow \leftarrow ④ \quad V \,/\!/\, Ħ$$

$$= 0 \qquad [6-11]$$

Of course, it has

$$v \times ħ = 0 \qquad [6-12]$$

$$v^* \times ħ^* = 0 \qquad [6-13]$$

However, the solution exists in the vector product of v and $ħ^*$, v^* and $ħ$. Here, they have

$$v \times ħ^* = -v^* \times ħ \qquad [6-14]$$

Then,

$$v \times ħ^* = (v_1, v_2, v_3) \times (ħ^*_1, ħ^*_2, ħ^*_3)$$

$$= [^{ⓐ}(v_2 ħ^*_3 - v_3 ħ^*_2,\ v_3 ħ^*_1 - v_1 ħ^*_3,\ v_1 ħ^*_2 - v_2 ħ^*_1),$$

$$^{ⓑ}(v_1 \times ħ^*_1,\ v_2 \times ħ^*_2,\ v_3 \times ħ^*_3)]$$

The general solution is only part ⓐ that is not part ⓑ. Why is part ⓑ gotten? As for the reason, v_j and $ħ^*_j$ are not on the same dimension to direct. In other words, the relation between v_j and $ħ^*_j$ are not parallel. Of course, the relation between v_j and $ħ^*_k$ are not orthogonal. I get

$$л^*_j = -[(л_k, л_n)] \qquad [6-15]$$

from ③ in [6 - 7]. Also

$$v_j \times ħ^*_j = e^{+\rho}{}_j e^{-\rho}{}_j (л_k - л_n)$$

$$= (л_k - л_n) \qquad [6-16]$$

I rewrite part ⓑ based on there.

$$^{ⓑ}(v_1 \times ħ^*_1,\ v_2 \times ħ^*_2,\ v_3 \times ħ^*_3) = cħ(л_2 - л_3,\ л_3 - л_1,\ л_1 - л_2) \qquad [6-17]$$

Clearly, [6 - 17] expresses the spin of the vector [Fig.7]. From above, I get

$$\mathbf{v}\times\hbar^{*}= c\hbar\,[{}^{ⓐ}(л_2^2-л_3^2,\ л_3^2-л_1^2,\ л_1^2-л_2^2),\quad {}^{ⓑ}(л_2-л_3,\ л_3-л_1,\ л_1-л_2)] \qquad [6-18]$$

However, this solution becomes zero if I adapt value simply. It does not become zero that is in only case which there has the curvature in the anguler space as the description in the front-chapter and δ_j is equipped with micro-anguler $\varDelta\delta_j$. I rewrite part ⓐ like [3－2], as follows.

$$л_j^2-л_k^2=(л_j+iл_k)^2 \qquad \because\ л_j\perp л_k \qquad [6-19]$$

It is the scalar that exists in the gap space and appears in the real space. In other words, $\mathbf{v}\times\hbar^{*}$ is the vector on the real space which has core of the gap space in case of the whole space has the curvature.

I replace $(л_j+iл_k)$ to $(л_j,\ iл_k)$ easy to evaluate. The subordination of $л_j$ and $iл_k$ have a circle O to draw in the event of the vector motions of precession which was expressed in [Fig.6]. I can say that $(л_j,\ iл_k)$ motions of precession with minimal changes of δ_j. However, this is the phenomenon that exists in the gap space only.

I think it is the property (the moment) that is the base of the "force" and "charge". In other words, the one, which can be seen in the real space, seems to base of the "moment of the force" and the one, which can be seen in the gap space, seems to base of the "moment of the charge (magnetic moment)".

Next, I get

$$\mathbf{v}^{*}\times\hbar=(v^{*}_1,\ v^{*}_2,\ v^{*}_3)\times(\hbar_1,\ \hbar_2,\ \hbar_3)$$

$$= c\hbar\,[{}^{ⓒ}(л_3^2-л_2^2,\ л_1^2-л_3^2,\ л_2^2-л_1^2),\quad {}^{ⓓ}(л_3-л_2,\ л_1-л_3,\ л_2-л_1)] \qquad [6-20]$$

from [6－14]. Part ⓒ reverses the area in the real space of $c\hbar$ to part ⓐ. Part ⓑ reverses the spin direction of the vector to part ⓓ.

Incidentally, the dimension of $c\hbar$ becomes $[V^1A^1m^1s^1]$ in the VAMS dimension system ("KAGAKU" 2002, 1. <The electromagnetism dimension is not difficult> Isao Imai).

Discussion of in here, I can extend it in the gap space. Express V is ${}_gV$ and Ħ is ${}_g$Ħ, in there.

$${}_g\mathbf{v}\cdot{}_g\hbar = c\hbar\,[\ \Sigma_{(j=1,2,3)}\sin^4\theta_j\, e^{+i\rho_j} e^{-i\rho_j}\cos^2\delta_j]$$

$\downarrow \leftarrow \qquad e^{+i\rho_j} e^{-i\rho_j} = 1$

$\downarrow$

$= c\hbar\,[\ \Sigma_{(j=1,2,3)} \sin^4\theta_j \cos^2\delta_j\,]$ [6 − 21]

${}_g\mathbf{v} \times {}_g\hbar^* = c\hbar\,[{}^{ⓐ}(ж_j^2 - ж_k^2)\ ,\ {}^{ⓑ}(ж_j - ж_k)]_{[j=1,2,3\quad k=1,2,3]}$

$\downarrow \leftarrow \qquad ж_j = л_j$

$\downarrow \qquad ж_j^2 = л_j^2$

$= c\hbar\,[{}^{ⓐ}(л_j^2 - л_k^2)\ ,\ {}^{ⓑ}(л_j - л_k)]_{[j=1,2,3\quad k=1,2,3]}$ [6 − 22]

Scalar product ${}_g\mathbf{V} \cdot {}_g\text{Ħ}$ becomes the same as $\mathbf{V} \cdot \text{Ħ}$.

$${}_g\mathbf{V} \cdot {}_g\text{Ħ} = \mathbf{V} \cdot \text{Ħ} \qquad [6-23]$$

Also, I can see that the part of the property leaks into the real space on the vector product.

In this section, we found the “quantum operation $c\hbar$ has spin with the motion of precession at tilt angular $\varDelta\delta_j$ in the curvature space”.

Clearly, the cause of the anomalous magnetic moment is this motion of precession. Also, this motion of precession raises the fluctuation.

6-(2) Vector analysis (supplement)

Here, I state the vector operation method that appears after this.

First, I reconsider the scalar product that operated in the front-chapter. I have ③ in [6 − 7], there.

$$(\sin^2\theta_j e^{\pm\rho_j} \sin\delta_j) = -[(\sin^2\theta_k e^{\pm\rho_k} \cos\delta_k)\ ,\ (\sin^2\theta_n e^{\pm\rho_n} \cos\delta_k)]$$

However, I can expresse

$$(\sin^2\theta_j e^{\pm\rho_j} \sin\delta_j) = [(\sin^2\theta_k e^{\pm\rho_k} \cos\delta_k)\ ,\ (\sin^2\theta_n e^{\pm\rho_n} \cos\delta_k)] \qquad [6-24]$$

by the direction and the order of the vector.

I appear them for the future, as follows.

$\mathbf{R} = (\mathbf{r}, \mathbf{r}^*)$

$r_j = c\,\omega_j^3 e^{+\rho_j} \cos\delta_j / (\sigma_j^2 + \omega_j^2)^2 \qquad r^*_j = c\,\omega_j^3 e^{+\rho_j} \sin\delta_j / (\sigma_j^2 + \omega_j^2)^2$

$r_j = \; c \; я_j$ $\qquad r^*_j = \; c \; я^*_j$ [6 − 25]

$я_j = \; \sin^3 \theta_j e^{+\rho_j} \; \cos \delta_j$ $\qquad я^*_j = \; \sin^3 \theta_j e^{+\rho_j} \; \sin \delta_j$ [6 − 26]

Then, I get

$$я^*_j = \; (я_k, \; я_n) \qquad [6-27]$$

from [6 − 20]. Also,

$$\mathbf{R} \cdot \mathbf{R} = \; \mathbf{rr} + \mathbf{rr}^* + \mathbf{r}^*\mathbf{r} + \mathbf{r}^*\mathbf{r}^*$$

$$\mathbf{rr} = \; 1 \Sigma_{(j=1,2,3)} [\, r_j^2 \,] \qquad [6-28]$$

$$\mathbf{rr}^* = \; 2 \Sigma_{(j=1,2,3)} [\, r_j^2 \,] \qquad [6-29]$$

$$\mathbf{r}^*\mathbf{r} = \; 2 \Sigma_{(j=1,2,3)} [\, r_j^2 \,] \qquad [6-30]$$

$$\mathbf{r}^*\mathbf{r}^* = \; 4 \Sigma_{(j=1,2,3)} [\, r_j^2 \,] \qquad [6-31]$$

Next, I explain the scalar product about vector **a** by fractional vector (1／**b**).

$$\mathbf{a} \cdot (1／\mathbf{b}) = \mathbf{a} \cdot [\mathbf{b}／(\mathbf{b} \cdot \mathbf{b})]$$

$$= \mathbf{a} \cdot \mathbf{b}／b_j^2$$

$$= a_j b_j／b_j^2 \qquad (\; = a_j／b_j \quad \text{especially}) \qquad [6-32]$$

Incidentally, (1／**b**) is not reverse vector $\mathbf{b}^{-1}$ of **b**. Call it the “scalar fraction product calculation”.

Also, I explain the vector product **a**×(1／**b**).

$$\mathbf{a} \times (1／\mathbf{b}) = \mathbf{a} \times [\mathbf{b}／(\mathbf{b} \cdot \mathbf{b})]$$

$$= \mathbf{a} \times (\mathbf{b}／b_j^2) \qquad [6-33]$$

This is the “vector fraction product calculation”.

7. Confinement and the mixture of mass

7-(1) Find the mass expression

I think that whole-space $\mathbf{H}^9$ has viscosity, because light velocity is limited in c. Generally, the kinematic viscosity that measures viscosity is a term. The persons who believed that the space has filled with ether thought this kinematic viscosity creates mass are the primary cause (Concepts of Mass, "written by Max Jammer" Kodansha). I replace this idea to the measure of the movement difficulty now.
I integrate elementary function a_j, and get the movement difficulty.

$$\mathbf{B} = (\mathrm{b}, \mathrm{b}^*)$$

I use "angular momentum" ℍ and $\mathbf{B}$ for express mass. | ℍ | is absolute value of ℍ.

$$| ℍ | = ℍ_j$$

$$= \hbar \left[\Sigma_{(j=1,2,3)} \sin^4\theta_j e^{-2\rho_j} \cos^2\delta_j \right]^{1/2} \qquad [7-1]$$

Then I get mass expression

$${}_1M_j = ℍ_j / (\mathbf{A} \cdot \mathbf{B}) \qquad [7-2]$$

$$= [ℍ_j / (c^2 \Sigma_{(j=1,2,3)} \sin^5\theta_j e^{+2\rho_j} \cos^2\delta_j)]$$

$$= (\hbar w / c^2)[(\Sigma_{(j=1,2,3)} \sin^4\theta_j e^{-2\rho_j} \cos^2\delta_j)^{1/2} / (\Sigma_{(j=1,2,3)} \sin^5\theta_j e^{+2\rho_j} \cos^2\delta_j)]$$

By the way, the mass expression is not only one but also seven kinds at least. by using this ℍ$_j$, as follows.

$${}_2M_j = ℍ_j / (\mathbf{V} \cdot \mathbf{R}) \qquad [7-3]$$

$$= [ℍ_j / (c^2 \Sigma_{(j=1,2,3)} \sin^5\theta_j e^{+2\rho_j} \cos^2\delta_j)]$$

$${}_3M_j = ℍ_j \mathbf{V} / (\mathbf{A} \cdot \mathbf{R} \cdot \mathbf{R}) \qquad [7-4]$$

$$= (ℏ_j / c^2)[(\Sigma_{(j=1,2,3)} \sin^5\theta_j e^{+2\rho_j} \cos^2\delta_j) / (\Sigma_j A_j R_j)(\Sigma_j R_j R_j)]$$

$${}_4M_j = ℏ_j \mathbf{R} / (\mathbf{V}\cdot\mathbf{V}\cdot\mathbf{B}) \qquad {}_5M_j = ℏ_j \mathbf{B} / (\mathbf{R}\cdot\mathbf{R}\cdot\mathbf{R})$$

$${}_6M_j = ℏ_j \mathbf{A} / (\mathbf{V}\cdot\mathbf{V}\cdot\mathbf{V}) \qquad {}_7M_j = ℏ_j (\mathbf{A}\cdot\mathbf{A}\cdot\mathbf{R}) / (\mathbf{V}\cdot\mathbf{V}\cdot\mathbf{V}\cdot\mathbf{V}\cdot\mathbf{V})$$

(A part was simplified because it became long). Probably, the movement difficulty becomes empty by these expressions.

In addition to the above, I can make mass expression

$${}_0M_j = E_j / (\mathbf{V}\cdot\mathbf{V}) \qquad [7-5]$$

$$= (E_j / [c^2 (\Sigma_{(j=1,2,3)} \sin^4\theta_j e^{+2\rho_j} \cos^2\delta_j)]$$

even if use "moment of force"

$$\mathbf{E} = (\varepsilon, \varepsilon^*) \qquad [7-6]$$

as described in 4-(2). E_j has energy that is the absolute value of **E**. Which one should I choose? However, I get the identical mass expression m_j that pay attention to these one dimensions only. It is the single dimension analysis. It has

$$m_j = \hbar w / (c^2 \sin^3\theta_j e^{+3\rho_j} \cos\delta_j) \qquad [7-7]$$

This is the Fundamental Mass Expression.

It seems to be that ${}_0M_j$ to ${}_7M_j$ expresse the composit particle because fundamental mass m_j exists in there. Here, I examine ${}_2M_j$ as an example but do not specify each expression. Rewrite it to

$${}_2M_j = (\hbar w / c^2)[(\Sigma_{(j=1,2,3)} \sin^4\theta_j e^{-2\rho_j} \cos^2\delta_j)^{1/2} / (\Sigma_j V_j R_j)] \qquad [7-8]$$

Pay attention to $Q_j = (\Sigma_{(j=1,2,3)} \sin^4\theta_j e^{-2\rho_j} \cos^2\delta_j)^{1/2}$. The details are

$$Q_j = (\sin^4\theta_j e^{-2\rho_j} \cos^2\delta_j + \sin^4\theta_k e^{-2\rho_k} \cos^2\delta_k + \sin^4\theta_n e^{-2\rho_n} \cos^2\delta_n)^{1/2} \qquad [7-9]$$

This expression composed by three ingredients that cannot resolve. Surely, such elementary particles exist. For example, "proton" that I cannot take composed by three quarks out independently and so on.

Also, I can make

$$Q_j = (\sin^4 \theta_j e^{-2\rho_j} \cos^2 \delta_j + \sin^4 \theta_j e^{-2\rho_j} \sin^2 \delta_j)^{1/2} \qquad [7-10]$$

by operate [7 − 5]. This is the "meson" that is composed by two quarks and so on.

I seem that "three generations" are three B=W circles on each three dimensions and can proof the "mixture of mass and the quark confinement" by [7 − 9], [7 − 10]. Also, I can explain that the mass expression has the "mixture of the generation" by one of m_j appears one of generation

Addition, I can describe the foundation cause of the "neutrino oscillation" by the mixture of the generation.

7-(2) Angular momentum and spin

Once, I get the mass expression, it is easy to find the other physical quantity on the classical. However, do not make it a principal objective and I reconsider spin. Begin at ${}_2M_j$ as previous. Then, momentum ${}_2\mathbf{P}$ has

$${}_2\mathbf{P} = {}_2M_j \mathbf{V} \qquad \{ = \hbar_j \mathbf{V} / (\mathbf{V} \cdot \mathbf{R}) \}$$

$$= \hbar_j / \mathbf{R} \qquad [7-11]$$

Angular momentum ${}_2\mathbf{L}$ has

$${}_2\mathbf{L} = {}_2\mathbf{P} \times \mathbf{R} \qquad \{ = (\hbar_j / \mathbf{R}) \times \mathbf{R} \}$$

$$= (\hbar_j / R_j^2) \mathbf{R} \times \mathbf{R}$$

$$= 0 \qquad \because \mathbf{R} /\!/ \mathbf{R} \qquad [7-12]$$

Therefore, I use $\mathbf{r}$ and $\mathbf{r}^*$ for the replacement of $\mathbf{R}$. Refer from [6 − 24] to [6 − 27], I get

$${}_2l_a = (\hbar_j / r_j^2) \mathbf{r} \times \mathbf{r} \qquad [7-13]$$

$$= 0$$

$${}_2l_b = (\hbar_j / r_j^{*2}) \mathbf{r}^* \times \mathbf{r}^*$$

$= \ 0$

${}_2\mathrm{l}_c = \ (\text{Ħ}_j / r_j r_j)\mathbf{r} \times \mathbf{r}^*$

$= \ [1](\text{Ħ}_j / \Sigma_{(j=1,2,3)} \, [\, r_j^2 \,])\ \mathbf{r} \times \mathbf{r}^*$

${}_2\mathrm{l}_d = \ (\text{Ħ}_j / r_j r_j^*)\mathbf{r}^* \times \mathbf{r}$

$= \ [1/2](\text{Ħ}_j / \Sigma_{(j=1,2,3)} \, [\, r_j^2 \,])\ \mathbf{r}^* \times \mathbf{r}$

${}_2\mathrm{l}_e = \ (\text{Ħ}_j / r_j^* r_j)\mathbf{r} \times \mathbf{r}^*$

$= \ [1/2](\text{Ħ}_j / \Sigma_{(j=1,2,3)} \, [\, r_j^2 \,])\ \mathbf{r} \times \mathbf{r}^*$

${}_2\mathrm{l}_f = \ (\text{Ħ}_j / r_j^* r_j^*)\mathbf{r}^* \times \mathbf{r}$

$= \ [1/4](\text{Ħ}_j / \Sigma_{(j=1,2,3)} \, [\, r_j^2 \,])\ \mathbf{r}^* \times \mathbf{r}$

${}_2\mathbf{s}$ spin quantum number appeared here.

$${}_2\mathbf{s} = \ 0, \quad 1/4, \quad 1/2, \quad 1 \qquad [7-14]$$

Spin quantum number [1/4] is an interesting value.

The vector quantum that exists in the quantization unit space has elevation angle Θ_e that was fixed on each space dimention. Also, I describe that this elevation angule Θ_e is the tilt angle of electron already. Therefore

$$\cos^2 \delta_j = \ 1/3 \qquad [7-15]$$

will be formed even if $\cos^2 \delta_j$ of

$$\Sigma_{(j=1,2,3)} \, [\, r_j^2 \,] \ = \ (c^2/w^2)\, \Sigma_{(j=1,2,3)} \sin^6 \theta_j e^{-2\rho_j} \ \cos^2 \delta_j \qquad [7-16]$$

considers the micro angular. I take this $\cos^2 \delta$ out. Then, get

$$\Sigma_{(j=1,2,3)} \, [\, r_j^2 \,] \ = \ (c^2/w^2) \cos^2 \delta \ \ \Sigma_{(j=1,2,3)} [\, p_j^2 \,] \qquad [7-17]$$

Next, I take $\cos \delta$ out in Ħ_j, as follows.

$$\text{Ħ}_j = \ \hbar \cos \delta \, [\, \Sigma_{(j=1,2,3)} \sin^4 \theta_j e^{-2\rho_j} \,]^{1/2}$$

$$= \hbar \cos\delta\,[\Sigma_{(j=1,2,3)}\, h_j^2\,]^{1/2} \qquad [7-18]$$

In other words,

$$\cos\delta \,/\, \cos^2\delta = \sqrt{3} \qquad [7-19]$$

is included on a series of expressions in angurae-momentum $_2\mathbf{l}$ that you can see [7 − 13]. Considering above, I can rewrit them as follows.

$$_2l_a = (\text{Ħ}_j / r_j^2)\mathbf{r}\times\mathbf{r} \qquad [7-20]$$

$$= 0$$

$$_2l_b = (\text{Ħ}_j / r_j^{*2})\mathbf{r}^*\times\mathbf{r}^*$$

$$= 0$$

$$_2l_c = (\text{Ħ}_j / r_j r_j)\mathbf{r}\times\mathbf{r}^*$$

$$= [\sqrt{3}]\,\hbar\,[(\Sigma_{(j=1,2,3)}\, h_j^2)^{1/2} / \Sigma_{(j=1,2,3)}\, p_j^2]\ \text{я}\times\text{я}^*$$

$$_2l_d = (\text{Ħ}_j / r_j r_j^*)\mathbf{r}^*\times\mathbf{r}$$

$$= [\sqrt{3}/2]\ \hbar\,[(\Sigma_{(j=1,2,3)}\, h_j^2)^{1/2} / \Sigma_{(j=1,2,3)}\, p_j^2]\ \text{я}^*\times\text{я}$$

$$_2l_e = (\text{Ħ}_j / r_j^* r_j)\mathbf{r}\times\mathbf{r}^*$$

$$= [\sqrt{3}/2]\ \hbar\,[(\Sigma_{(j=1,2,3)}\, h_j^2)^{1/2} / \Sigma_{(j=1,2,3)}\, p_j^2]\ \text{я}\times\text{я}^*$$

$$_2l_f = (\text{Ħ}_j / r_j^* r_j^*)\mathbf{r}^*\times\mathbf{r}$$

$$= [\sqrt{3}/4]\ \hbar\,[(\Sigma_{(j=1,2,3)}\, h_j^2)^{1/2} / \Sigma_{(j=1,2,3)}\, p_j^2]\ \text{я}^*\times\text{я}$$

Spin angular momentum $_2\mathbf{S}$ appeared in here. Gather them.

$$_2\mathbf{S} = 0,\ \ \sqrt{3}\,\hbar,\ \ \sqrt{3}/2\,\hbar,\ \ \sqrt{3}/4\,\hbar \qquad [7-21]$$

I consider them in the simple use the single dimension space. For example, I have vector **P** in here. Suppos that this **P** has tilt angle Θ_e to axis z. The projection on z of this **P** is expressed in $p_j = P_j \cos\Theta_e$. This is replaced in $P_j = p_j / \cos\Theta_e$. In other words, get $P_j = \sqrt{3}\, p_j$. By the way, it is $p_j = Ħ_j / [\, r_j^2 \,]$ in case of now, so we get

$$P_j = \sqrt{3}\ Ħ_j / [\, r_j^2 \,]$$

This vector **P** is expressed with

$$P_j = \sqrt{3}\ Ħ_j / \Sigma_{(j=1,2,3)} [\, r_j^2 \,]$$

because it has tilt angle Θ_e on all axes x, y, and z. I extended the techniques that explain the spin quantum number of electron **s** and spin angular momentum **S** by the inclination of the vector to be often used.

I get spin quantum number $_3$**s** and spin angular momentum $_3$**S** by pursue from mass $_3$**M**, as follows.

$$_3\mathbf{s} = \ 0, \quad 1/4, \quad 1/2, \quad 1, \quad 2, \quad 4 \qquad [7-22]$$

$$_3\mathbf{S} = \ 0, \quad \sqrt{3}/4\ \hbar, \quad \sqrt{3}/2\ \hbar, \quad \sqrt{3}\ \hbar, \quad 2\sqrt{3}\ \hbar, \quad 4\sqrt{3}\ \hbar \qquad [7-23]$$

7-(3) Quantum operator G and mass

I got quantum operator $c\ \hbar$ in 6-(1). Give it two symbols,

$$G_j = \mathbf{V} \cdot Ħ \qquad \{ = c\hbar\, [\ \Sigma_{(j=1,2,3)} \sin^4\theta_j \cos^2\delta_j\,]\ \} \qquad [7-24]$$

$$\mathbf{G} = \mathbf{V} \times Ħ \qquad \{ = \text{reference } [6-18], [6-20]\, \} \qquad [7-25]$$

I make some mass expressions based on them. I get mass expression

$$_G M_j = G_j / [\, \mathbf{V} \cdot (\mathbf{V} \times \mathbf{R})] \qquad [7-26]$$

$$= Ħ / (\mathbf{V} \times \mathbf{R}) \quad \{ = Ħ \cdot (\mathbf{V} \times \mathbf{R}) / (V_j \times R_j)^2 \} \qquad [7-27]$$

$$= Ħ \cdot (\mathbf{V} \times \mathbf{R}) / [2\, g(\, v_j \times r_j)]$$

by G_j, because the mass is a scalar. The upper and lower expression changes a solution by the preceded calculation. Then, I get

$$G_j / [\, \mathbf{V} \cdot (\mathbf{V} \times \mathbf{R})] \neq Ħ / (\mathbf{V} \times \mathbf{R}) \qquad [7-28]$$

[7 − 27] expresses spin.

Next, I use **G** then get

$$ {}_{G}M_j = \mathbf{G} / [\,\mathbf{V} \cdot \mathbf{V} \cdot \mathbf{R}\,] $$

$$ = \mathbf{G} \cdot \mathbf{R} / [\,V_j{}^2 R_j{}^2\,] \qquad [7-29] $$

I can create the mass expression that has spin by quantum operator c ℏ, in this way.

Quantum operator **G** shows the property and G_j shows size. In this way, I seem the mass needs enormous energy by the mass expression becomes complexity in the real world. I take the property of the quantum operator below.

① Almost all energy is converted into the mass in case of the isolate quantum operator cannot move around in some cause.

② The energy is distributed the minimal bond energy of elementary particles and the huge mass in case of the unisolat quantum operator does not move around.

③ The energy is distributed the maximal bond energy of elementary particles, kinetic energy and the comparatively small mass in case of the unisolat quantum operator can move.

④ Almost all energy is coverted to kinetic energy and zero or minimal energy for the mass in case of the isolated quantum operator can move around.

I can adapt all spin to all property. Then, ④ seems to express a photon and a neutrino. I cannot exclude the possibility that the photon has the minimal mass in this meaning. If the photon has mass, the light velocity does not maximum speed in the whole space and it lines the proper-ness of the observation result that a speed difference between a photon and a neutrino is hardly seen.

Therefore, light velocity c takes the consistence with Planck's constant ℏ in this way.

By the way, the spin exists in the mass expression that is equivalent to the fermion. I can create a lot of expression that describe it. For example, it is expressed with

$$_0M_j = \mathbf{E} ／(\mathbf{V}\times\mathbf{V})$$

$$= \mathbf{E}\cdot(\mathbf{V}\times\mathbf{V}) ／(V_j\times V_j)^2 \qquad [7-30]$$

$$= \mathbf{E}\cdot(\mathbf{V}\times\mathbf{V}) ／[2 f (v_j\times v_j)]$$

and so on that use “moment of force” **E** again. Value “2” is naturally led to inside [7 − 23] and the expression in this place by the calculation. Spin quantum number **s**=1／2 is expressed.

Incidentally, $_1M_j$ to $_7M_j$ appear the same expressions in the same way. I call it the “Duality”.

The relation between Planck mass M_p and gravitational constant G_N is

$$M_p=(c\ \ \hbar ／G_N)^{1／2}$$

I adjust it to the GAPS theory, as follows.

$$\mathbf{G} = G_N M_p^2, \qquad G_j = G_N M_p^2 \qquad [7-31]$$

Then, I extend them to the gap space,

$$_g\mathbf{G} = {}_g\mathbf{V}\times{}_g\mathbf{H}, \qquad {}_gG_j = {}_g\mathbf{V}\cdot{}_g\mathbf{H} \qquad [7-32]$$

Therefore, get

$$_g\mathbf{G} = G_N M_p^2, \qquad {}_gG_j = G_N M_p^2 \qquad [7-33]$$

The property of $_g\mathbf{G}$ leaks into the real space and absolute value G_j and $_gG_j$ becomes equal, as I gotten in [6 − 21], [6 − 23]. This discussion has the phenomenon describe essence in whole space $\mathbf{H}^9$.

8. Unification of the interaction

8-(1) Fractional charge and the elementary charge

The Coulomb’s law is

$$F_j = Q_j \cdot \mathbf{E}$$

It is rewritten to

$$\mathbf{F}_q = Nq_j{}^2 / r_j{}^2 \qquad (N = n / 4\pi\varepsilon_0 , \quad \text{'n' has not dimension})$$

Here, I make

$$\mathbf{F}_q = Nq_j{}^2 / (\mathbf{R} \cdot \mathbf{R}) \qquad [8-1]$$

I suppose that r_j is same as **R** in the GAPS theory, and 'n' has the reciprocal of fine structure constant α here now. Then, get

$$Nq_j{}^2 = c\hbar \qquad (\alpha = e^2 / 4\pi\varepsilon_0 c\hbar)$$

By the way, I necessary make vector $Nq_j{}^2$ in some case from [8 − 1], then I make that use **G** and G_j as follows.

$$q_j{}^2 = G_j / N \qquad [8-2]$$

$$q_j{}^2 = \mathbf{G} / N \qquad [8-3]$$

Therefore, [8 − 1] becomes

$$\mathbf{F}_q = \mathbf{G} / R_j{}^2 \qquad [8-4]$$

by [8 − 3]. Write down one of this specific expression.

$$\begin{aligned} {}_1\mathbf{f}_q &= \mathbf{g} / r_j{}^2 \\ &= \mathbf{v} \times \hbar^* / r_j{}^{*2} \qquad [8-5] \end{aligned}$$

Here, I think about electric charge q_j. [8 − 2] and [8 − 3] have three elements and spin that cannot be divided as we discussed about the quantum operator in 6-(1). In this reason, I conclude that the fractional charge cannot exist in the real world.

Incidentally, I make that one of element is a charge with one of quark. In this meaning, I can describe what the fractional charge is confined by same as the confinement theory with mass. Therefore, in case of

$$\begin{aligned} q_j &= (G_j / N)^{1/2} \\ &= [\, c\hbar\, (\Sigma_{(j=1,2,3)} Л_j{}^2) / N \,]^{1/2} \end{aligned}$$

$$= [\, c\hbar\,(л_1^2 + л_2^2 + л_3^2)/N\,]^{1/2} \qquad [8-6]$$

, three 1／3 fractional charges compose one electric charge.　Also, I consider

$$л_j^{*2} = (л_k^2 \ ,\ л_n^2) \qquad [8-7]$$

, [8 − 6] is rewritten to

$$q_j = [\, c\hbar\,(л_1^2 + л_1^{*2})/N\,]^{1/2} \qquad [8-8]$$

I can understand what this expression is composed by one 1／3 fractional charge and one 2／3 fractional charge.

8-(2)　Gravitation and the Coulomb force

I explain the gravitation of the GAPS theory.

Generally, the Planck mass is given in

$$m_p = \hbar / (c^2\, t_{pl})$$

I place it on my mind.　Then, show [7 − 7] and those ghosts are as follows.

$$m_j = \hbar w / (c^2 \sin^3\theta_j e^{+3\rho_j} \cos\delta_j)$$

$$m_j^* = \hbar w / (c^2 \sin^3\theta_j e^{+3\rho_j} \sin\delta_j) \qquad [8-15]$$

I take the limitation of this ghost [8 − 15] as follows.　The phase transition starts from $\theta_j \to \pi/2$ in $\delta_j \to 0$.　I get

$$\lim_{[\theta_j \to \pi/2,\ \delta_j \to 0]} m_j^* = \hbar / (c^2\, t_{pl}) \qquad [8-16]$$

from

$$\lim_{[\theta_j \to \pi/2]} \sin^3\theta_j = 1, \qquad \lim_{[\theta_j \to \pi/2]} e^{+3\rho_j} = 1$$

$$\lim_{[\delta_j \to 0]} \sin\delta_j = \delta_j, \qquad \delta_j = w\tau, \qquad \tau = t_{pl}$$

Clarifying by this, the mass expression of the GAPS theory includes Planck mass.　Also, I understand what the Planck mass appears in which situation.

The general gravitation is given in

$$\mathbf{F}_G = G_N\, m_j^2 / r_j^2$$

Of course, I can modify this geavitational constant G_N into

$$G_N = c\hbar / m_p^2$$

$$= (V \cdot \hbar\!\!\!/) / {}_1M_j^2 \qquad [\text{or} \quad = (V \times \hbar\!\!\!/) / {}_1M_j^2 \;] \qquad [8-17]$$

and so on. Therefore, I get

$$\mathbf{F}_G = \mathbf{G} / R_j^2 \qquad [8-18]$$

The Coulomb force [8 - 4] and this gravitation [8 - 18] are the same completely in the given limitation. By the way, if the angular space does not have the curvature, this force becomes zero as I described [6 - 11]. However, in case of the curvature exists, the amount of force gets feeble force,

$$\mathbf{F}_G = \mathbf{G} / R_j^2$$

$$= \zeta_0 \qquad [8-19]$$

This is the gravitation, the force that forms the present space.

The solutions with specific force are as follows.

$${}_1\mathbf{f} = \mathbf{v} \times \hbar^* / r_j^2 \qquad [8-20]$$

$${}_2\mathbf{f} = \mathbf{v} \times \hbar^* / r_j r_j^* \qquad [8-21]$$

$${}_3\mathbf{f} = \mathbf{v} \times \hbar^* / r_j^{*2} \qquad [8-22]$$

Incidentally,

$$\mathbf{v} \times \hbar^* = \hbar \times \mathbf{v}^*, \qquad \mathbf{v}^* \times \hbar = \hbar^* \times \mathbf{v}$$

Also,

$$\mathbf{v} \times \hbar^* = -\hbar^* \times \mathbf{v}, \qquad \mathbf{v}^* \times \hbar = -\hbar \times \mathbf{v}^*$$

expresses spin-flip. I suppose what these forces become different one each other so the spin quantum number to be decided by r_j^2, $r_j r_j^*$, r_j^{*2}. Also, I seem that "$\mathbf{v} \times \hbar$", "$\mathbf{v}^* \times \hbar^*$" are zero even if the angular space has curvature. Then, I can assume that the negative force exists in all of them. Actually, the general solution has 18 kinds of force. But they are settled into 3 kinds by degeneracy. I understand that these forces are the same ones at the point of the phase transition in the whole space or in the situation that can take the limitation at the present space.

I extract all kinds of the force to avoid misunderstanding. We have four kinds of the force, "$_1$**f**", "$_2$**f**", "$_3$**f**" and amount of force "$\mathbf{F}_G$" includes them.

Here, I could prove the Grand Unified Theory.

9. Next Stage

We sow that all pending issues are solved in the GAPS theory. However, the unspecific solution exists there. For example, we could not find the value of the quark-mixing angle and so on logically. You will say that I selected value with the electric charge and the gravitation constant only. I did not make relation between the anomalous magnetic moment and the curvature of the angular space clear. However, I think that we have the solvent of these issues. I will show an equivalent circuit like [Fig.8] as one guidepost. I can bring this equivalent circuit in the whole space that is made by the oscillation. However, I do not tell the much, because they have possibility to lose sight of the whole by this very complicated discussion. Also, the reason why I do not step into this place more than it is in Nobel Prize winning performance by Doctor Masayoshi Koshiba. Say,

"The neutrino oscillation will be proved now, it is not strange even if someone gets the simple theory which explains mass". □