Event matching process with quantum theory

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Abstract

Event is not only a process take effect but also a process accumulates changes, to let these two represent the same event, there should be an equation exists between them. From this idea with matching law of events, this article introduces a new method lead to quantum field. With irreversible exchange happening with matching law, we can build the relationship between the Higgs' field and space-time. By calculation, we can get metric which approximate to SchwarzschildKarl's solution far away from the field vibration center.

Keywords: Event, Match, Exchange, Higgs, Metric

1 Introduction

Event objects existing in space-time have 2 kinds of description in maths.

1. One is its effect changing over event process as: $\frac{d\varphi}{ds}$.
2. The other is an ordered collection of changes generated at different time, if these changes share an exchangeable and addable effect, then the event can be expressed as their accumulation : $\int \phi ds$.

To let these 2 description represent the same object, we can choose fields properly, let them satisfy:

$$\begin{aligned} \frac{d\varphi}{ds} &= \int \phi ds \\ \phi &= \hat{c}\varphi \end{aligned} \tag{1}$$

Equation 1 is the base idea of this article.

2 Event matching condition

For event can only happen once each time, prefer using most matching objects. We can also get Equation 1 by objects' extreme matching condition as:

$$ds = id\tau \tag{2}$$

$$\frac{d\langle\varphi \mid \varphi\rangle}{ds} = 0$$

$$\frac{d^2\langle\varphi \mid \varphi\rangle}{ds^2} = \kappa \leq 0 \tag{3}$$

In Equation 3, ds use real axis as event changing, different with $d\tau$ for the proper time.

The extreme condition can be divided into 2 parts. One makes object fitting from current to next, the other part makes them break away from each other. When the fitting part value becomes max, and the broken part becomes minimal, will make current matching with next in the event as: $\varphi^+\varphi = a^2 - b^2 = a^2 + (ib)^2$, in which a^2 represent fitting degree and b^2 express broken degree.

Equation 3 can only be used in same space-time, we need to extend it to different space-time, to let the extreme condition make sense over changes of space-time without event happen. We can make a projection from space-time x to space-time y as:

$$\vec{x} \to \vec{y}$$

$$\Delta V_x \to \Delta V_y$$

$$\varphi_x \to \varphi_y \tag{4}$$

This projection requires a field $L_{x|y}$ to connect x to y, as:

$$\frac{\varphi_x \Delta V_x}{\Delta L_{x|y}} \Delta L_{x|y} \to \frac{\varphi_y \Delta V_y}{\Delta L_{x|y}} \Delta L_{x|y}$$

Then we can define 2 new fields as:

$$\psi_{x|y:x} = \frac{\varphi_x \Delta V_x}{\Delta L_{x|y}}$$

$$\psi_{x|y:y} = \frac{\varphi_y \Delta V_y}{\Delta L_{x|y}} \tag{5}$$

Compare with matching value in same space-time:

$$\sum (\varphi_x^\dagger \varphi_x \Delta V_x) = \sum (\psi_{x|x:x}^\dagger \psi_{x|x:x} \frac{\Delta L_{x|x}}{\Delta V_x} \Delta L_{x|x}) \tag{6}$$

When choose:$\Delta L_{x|x} = \Delta V_x$, we can get:

$$\begin{aligned} \psi_{x|x:x} &= \varphi_x \\ \sum(\varphi_x^\dagger \varphi_x \Delta V_x) &= \sum(\psi_{x|x:x}^\dagger \psi_{x|x:x} \Delta L_{x|x}) = P \end{aligned} \tag{7}$$

Extending this result to different x and y, we can write matching value from x to y as:

$$\sum(\psi_{x|y:y}^\dagger \psi_{x|y:x} \Delta L_{x|y}) = P \tag{8}$$

Then the extreme matching condition becomes:

$$\begin{aligned} \frac{d}{dy}\sum(\psi_{x|y:y}^\dagger \psi_{x|y:x} \Delta L_{x|y}) &= 0 \\ \frac{d^2}{dy^2}\sum(\psi_{x|y:y}^\dagger \psi_{x|y:x} \Delta L_{x|y}) &= \kappa \end{aligned} \tag{9}$$

Then:

$$\begin{aligned} \kappa &= Pe \\ \sum \frac{d^2}{dy^2}(\psi_{x|y:y}^\dagger \psi_{x|y:x} \Delta L_{x|y}) &= \sum(e\psi_{x|y:y}^\dagger \psi_{x|y:x} \Delta L_{x|y}) \end{aligned} \tag{10}$$

Equation 10 shows an inner relationship without other object's field, we can expect it is true for every connection with a special field, then:

$$\frac{d^2}{dy^2}(\psi_{x|y:y}^\dagger \psi_{x|y:x} \Delta L_{x|y}) = e\psi_{x|y:y}^\dagger \psi_{x|y:x} \Delta L_{x|y} \tag{11}$$

We can rewrite it as:

$$\frac{d^2}{dy^2}(\psi_{x|y:y}^\dagger \varphi_x \Delta V_x) = e\psi_{x|y:y}^\dagger \varphi_x \Delta V_x \tag{12}$$

Because of φ_x and ΔV_x independent with y, we have:

$$\frac{d^2}{dy^2}\psi_{x|y:y} = e\psi_{x|y:y} \tag{13}$$

It is same as event equivalent Equation 1. Then we have:

$$\begin{aligned} \psi_{x|y:y}^\dagger \frac{d^2}{dy^2}\psi_{x|y:y} = e\psi_{x|y:y}^\dagger \psi_{x|y:y} &= \frac{d^2}{dy^2}\psi_{x|y:y}^\dagger \psi_{x|y:y} \\ \frac{d^2}{dy^2}(\psi_{x|y:y}^\dagger \psi_{x|y:y}) &= \psi_{x|y:y}^\dagger \frac{d^2}{dy^2}\psi_{x|y:y} + 2\frac{\psi_{x|y:y}^\dagger}{dy}\frac{\psi_{x|y:y}}{dy} + \frac{d^2}{dy^2}\psi_{x|y:y}^\dagger \psi_{x|y:y} \end{aligned} \tag{14}$$

By calculation, we can get:

$$\frac{1}{2}\frac{d^2}{dy^2}(\psi^\dagger_{x|y:y}\psi_{x|y:y}) = \frac{d\psi^\dagger_{x|y:y}}{dy}\frac{d\psi_{x|y:y}}{dy} + e\psi^\dagger_{x|y:y}\psi_{x|y:y} \tag{15}$$

The right term will become expression for Lagrange density in quantum theory when $y \to x$.

3 Gauge transformation in event

If we make a gauge transformation u, then because of Equation 13, we have:

$$u^{-1}\frac{d}{dy}[uu^{-1}\frac{d(u\psi_{x|y:y})}{dy}] = e\psi_{x|y:y} \tag{16}$$

Let $D_y = u^{-1}\frac{d}{dy}u$, we can rewrite it as: $D_y D_y \psi_{x|y:y} = e\psi_{x|y:y}$. Same for Equation 15, we have:

$$\begin{aligned}\frac{1}{2}\frac{d^2}{dy^2}(\psi^\dagger_{x|y:y}\psi_{x|y:y}) &= \frac{1}{2}\frac{d^2}{dy^2}[(u\psi_{x|y:y})^\dagger(u\psi_{x|y:y})] \\ &= \frac{d(u\psi_{x|y:y})^\dagger}{dy}\frac{d(u\psi_{x|y:y})}{dy} + e(u\psi_{x|y:y})^\dagger(u\psi_{x|y:y}) \\ &= (D_y\psi_{x|y:y})^\dagger D_y\psi_{x|y:y} + e\psi^\dagger_{x|y:y}\psi_{x|y:y}\end{aligned} \tag{17}$$

Which is naturally gauge invariant.

4 Irreversible exchange and Higgs mechanism

Equation 15 lacking Higgs term like ϕ^4, to get this term, we suppose when event objects accumulate along space-time connection made up from other objects, can generate a new different small change which can be added to objects' collection. But when the connection is made up of objects themselves, the changes generated will be overlap with route, lead to accumulation lost. To describe this process, we should understand events' connection mechanism first. Consider Higgs field $(0, \cdots, \phi)$, interact with a connection field as:

$$F = \begin{pmatrix} 0 & \cdots & f_1 \\ \vdots & \ddots & f_i \\ 0 & \cdots & 0 \end{pmatrix} \tag{18}$$

The matching value for Higgs' field before an event happen connected by field F is:

$$\psi^\dagger_{x|y:y}F^\dagger_{x|y:y}F_{x|y:x}\psi_{x|y:x}$$

$$= \begin{pmatrix} 0 & \cdots & \phi^\dagger_{x|y:y} \end{pmatrix} \begin{pmatrix} 0 & \cdots & 0 \\ \vdots & \ddots & \vdots \\ f^\dagger_{x|y:y.1} & f^\dagger_{x|y:y.i} & 0 \end{pmatrix} \begin{pmatrix} 0 & \cdots & f_{x|y:x.1} \\ \vdots & \ddots & f_{x|y:x.i} \\ 0 & \cdots & 0 \end{pmatrix} \begin{pmatrix} 0 \\ \vdots \\ \phi_{x|y:x} \end{pmatrix} \tag{19}$$

$$= \sum_i^{n-1} \left(f^\dagger_{y.i} f_{x.i} \phi^\dagger_y \phi_x \frac{\left(\Delta V_y \Delta V_x\right)^2}{\left(\Delta L_{x|y}\right)^4} \right) \tag{20}$$

Consider topology changed after the event happens, Higgs' field move forward, different side of the connection field will exchange relative to Higgs' field after event happen, then the matching value becomes:

$$\psi^\dagger_{x|y:y} F_{x|y:x} F^\dagger_{x|y:y} \psi_{x|y:x} = 0 \tag{21}$$

This means the connection cannot keep the vacuum field matching after the event happens, which cause vacuum field turn to use others' connection. As a result this event process is irreversible.

For extreme matching condition, to let the event happen, the connection matching value should reach as Higgs' field self matching value, as:

$$\psi^\dagger_{x|x:x} \psi_{x|x:x} = \psi^\dagger_{x|y:y} F^\dagger_{x|y:y} F_{x|y:x} \psi_{x|y:x} \tag{22}$$

The connection field F can be divided into 2 parts, one has Higgs' field take part in, the other part without Higgs' field, as:

$$\psi^\dagger_{x|x:x} \psi_{x|x:x} = \psi^\dagger_{x|y:y} B^\dagger_{x|y:y} B_{x|y:x} \psi_{x|y:x} + \psi^\dagger_{x|y:y} (\psi_{x|y:y} \Lambda^\dagger_{x|y:y} \Lambda_{x|y:x} \psi^\dagger_{x|y:x}) \psi_{x|y:x} \tag{23}$$

The second term at right is referring to Feynman kernel $|\psi\rangle\langle\psi|$, which used to build connections. In the equation above Λ satisfy:

$$\Lambda_{x|y:x} \psi^\dagger_{x|y:x} = \begin{pmatrix} \lambda_{x|y:x.1} \\ \lambda_{x|y:x.i} \\ 0 \end{pmatrix} \begin{pmatrix} 0 & \cdots & \phi^\dagger_{x|y:x} \end{pmatrix} = \begin{pmatrix} 0 & \ldots & \lambda_{x|y:x.1} \phi^\dagger_{x|y:x} \\ \vdots & \ddots & \lambda_{x|y:x.i} \phi^\dagger_{x|y:x} \\ 0 & \cdots & 0 \end{pmatrix} \tag{24}$$

Substitute into Equation 23, we get:

$$\phi^\dagger_x \phi_x \frac{\left(\Delta V_x\right)^2}{\left(\Delta L_{x|x}\right)^2} = \phi^\dagger_y \phi_x \frac{\left(\Delta V_y \Delta V_x\right)^2}{\left(\Delta L_{x|y}\right)^4} \sum_i^{n-1} \left(b^\dagger_{yi} b_{xi} + \phi_y \lambda^\dagger_{yi} \lambda_{xi} \phi^\dagger_x \frac{\Delta V_y \Delta V_x}{\left(\Delta L_{x|y}\right)^2} \right) \tag{25}$$

When $y \to x$, we can simplify it as:

$$\frac{\left(\Delta L_{x|x}\right)^2}{\left(\Delta V_x\right)^2} = \sum_i^{n-1} \left(b^\dagger_{xi} b_{xi} \right) + \phi^\dagger_x \phi_x \Lambda^\dagger_x \Lambda_x \frac{\left(\Delta V_x\right)^2}{\left(\Delta L_{x|x}\right)^2} \tag{26}$$

These fields will determine space-time's directions by their distribution to form different irreversible connection. The second term on the right side is coming from Higgs' field, so it will prefer towards the center of Higgs' field relate with radial direction. For the connection only has $n-1$ independent components, the first term on the right side can be rewritten as:

$$\sum_i^{n-1}(b^\dagger_{xi}b_{xi}) = \alpha^2\vec{x}_a\cdot\vec{x}_a + \sum_i^{n-3}\left(\theta^\dagger_{xi}\theta_{xi}\right), \alpha^2 < 0 \tag{27}$$

In which $\vec{x}_a$ is parallel to event's direction, θ_{xi} is independent with the other 2 directions relate with $\Delta L_{x|x}$. And α is event connecting strength. Then:

$$\vec{x}_a\cdot\vec{x}_a = \frac{1}{\alpha^2}\frac{\left(\Delta L_{x|x}\right)^2}{(\Delta V_x)^2} - \frac{\phi^\dagger_x\phi_x\Lambda^\dagger_x\Lambda_x}{\alpha^2}\frac{(\Delta V_x)^2}{(\Delta L_{x|x})^2} - \frac{1}{\alpha^2}\sum_i^{n-3}(\theta^\dagger_{xi}\theta_{xi}) \tag{28}$$

This can be used to generate metric of space with $g_{ab} = \vec{x}_a\cdot\vec{x}_b$ by rewriting it as:

$$\vec{x}_a = \frac{c_0}{\alpha}\frac{\Delta L_{x|x}}{\Delta V_x}\vec{e}_t + \sqrt{-\frac{\phi^\dagger_x\phi_x\Lambda^\dagger_x\Lambda_x}{\alpha^2}}\frac{\Delta V_x}{\Delta L_{x|x}}\vec{e}_r + \sum_i^{n-3}\sqrt{-\frac{1}{\alpha^2}(\theta^\dagger_{xi}\theta_{xi})}\vec{e}_i \tag{29}$$

In which c_0 is referred to light speed for difference of time's and distance's unit.

We can draw irreversible exchange with connection as below.

$$\tilde{\circ} \xrightarrow{\tilde{\bullet}} \xleftarrow{\bullet} \circ \xrightarrow{\bullet} \xleftarrow{\bullet} \circ \quad (1)$$
$$\circ \xleftarrow{\bullet} \xrightarrow{\tilde{\bullet}} \tilde{\circ} \xrightarrow{\bullet} \xleftarrow{\bullet} \circ \quad (2)$$
$$\circ \xleftarrow{\bullet} \xrightarrow{\bullet} \tilde{\circ} \xrightarrow{\tilde{\bullet}} \xleftarrow{\bullet} \circ \quad (3)$$

In which white points represent exchanging part of ψ without taking part in connection, and black points represent taking in part cause exchanging with self connection $\psi_{x|y:y}\Lambda^\dagger_{x|y:y}\Lambda_{x|y:x}\psi^\dagger_{x|y:x}$. The waves above indicate current field point, at step 1 it matches with the next point. Step 2 shows current point move forward after exchanging. And at step 3 it rematches to a new next point with self connection.

From the above process, we can find distance of black points is half of white points. It indicates exchange with self connection will lose half accumulation in the event process. Then we have:

$$\frac{d\phi_x}{ds} = \int A\left(\alpha^2 + \frac{\phi^\dagger_x\phi_x\Lambda^\dagger_x\Lambda_x}{2}\frac{(\Delta V_x)^2}{(\Delta L_{x|x})^2}\right)\phi_x ds \tag{30}$$

In which A is the rate of accumulation. Same as Equation 14, We can get:

$$\frac{d^2\phi_x}{ds^2} = \frac{d\phi_x^\dagger}{ds}\frac{d\phi_x}{ds} + A\left(\alpha^2 + \frac{\phi_x^\dagger\phi_x\Lambda_x^\dagger\Lambda_x}{2}\frac{(\Delta V_x)^2}{(\Delta L_{x|x})^2}\right)\phi_x^\dagger\phi_x \tag{31}$$

Then Higgs' field potential is:

$$V(\phi_x) = A\left(\alpha^2 + \frac{\phi_x^\dagger\phi_x\Lambda_x^\dagger\Lambda_x}{2}\frac{(\Delta V_x)^2}{(\Delta L_{x|x})^2}\right)\phi_x^\dagger\phi_x \tag{32}$$

Its value should be lowest, leading to vacuum state of Higgs' field becomes:

$$\sqrt{\phi_o^\dagger\phi_o} = v = \sqrt{-\frac{\alpha^2}{\Lambda_x^\dagger\Lambda_x}\frac{\Delta L_{x|x}}{\Delta V_x}} \tag{33}$$

5 Higgs mechanism with relativity theory

Substitute Equation 33 into Equation 28, we can get:

$$ds^2 = -\frac{c_0^2 v^2\Lambda_x^\dagger\Lambda_x}{\alpha^4}dt^2 + \frac{\phi_x^\dagger\phi_x}{v^2}dr^2 - \frac{1}{\alpha^2}\sum_i^{n-3}\left(\theta_{xi}^\dagger\theta_{xi}dz_i^2\right) \tag{34}$$

For geometry reason, space volume element's square will be proportional to: $\frac{\phi_x^\dagger\phi_x}{(-\alpha)^{2(n-3)}v^2}$. With Equation 33, we can get:

$$\frac{(\Delta V_x)^2}{(\Delta L_{x|x})^2} = \frac{c_1\phi_x^\dagger\phi_x}{(-\alpha)^{2(n-3)}v^2} = -\frac{\alpha^2}{v^2\Lambda_x^\dagger\Lambda_x} \tag{35}$$

We can simplify it by choosing $\Delta L_{x|x} = \Delta V_x$ at vacuum state, then $c_1 = (-\alpha)^{2(n-3)}$. Substitute into Equation 34, we have:

$$ds^2 = \frac{c_0^2 v^2}{\alpha^2\phi_x^\dagger\phi_x}dt^2 + \frac{\phi_x^\dagger\phi_x}{v^2}dr^2 - \frac{1}{\alpha^2}\sum_i^{n-3}\left(\theta_{xi}^\dagger\theta_{xi}dz_i^2\right) \tag{36}$$

Because Higgs' field can be represented as:

$$\phi_x = (v+\eta)e^{i\rho s} = \varphi e^{i\rho s} \tag{37}$$

We have:

$$\frac{v^2}{(\phi_x^\dagger\phi_x)^2} = \frac{(\varphi-\eta)^2}{\varphi^2} = 1 - \frac{2\eta}{\varphi} + \frac{\eta^2}{\varphi^2} \tag{38}$$

For v is Higgs' vacuum state relating with the lowest energy density of space-time, will not decrease as distance changing from the field vibration center, so when far away from the center: $v \gg \eta$ and $v \approx \varphi$, then:

$$ds^2 \approx \frac{c_0^2}{\alpha^2}\left(1 - \frac{2\eta}{v}\right) dt^2 + \left(1 - \frac{2\eta}{v}\right)^{-1} dr^2 - \frac{1}{\alpha^2}\sum_i^{n-3}\left(\theta_{xi}^{\dagger}\theta_{xi} dz_i^2\right) \tag{39}$$

Which is similar to SchwarzschildKarl's solution:

$$ds^2 = -c^2\left(1 - \frac{2GM}{r}\right) dt^2 + \left(1 - \frac{2GM}{r}\right)^{-1} dr^2 + r^2\left(d\theta^2 + \sin^2\theta d\varphi^2\right) \tag{40}$$

6 Conclusion

By analysing event's effects and accumulation property with their matching law, this article creates a new method to explain quantum theory and relativity theory. Naturally derive gauge transformation invariant by event relate equations. Explain space-time's formation with irreversible exchanging process, and make Higgs mechanism available for explaining relativity theory.

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