SPIN CONNECTION FIELD HYPOTHESIS

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Abstract. In this short paper i presented a simple mathematical model that can be solution to quantum gravity problem. It uses connection as mathematical model and spin field matrix that represents possible particles.

1. Basic ideas

I will assume all units are Planck units [1]. From it comes that speed of light is equal to one, I take one unit of space and divide it by one unit of time so I get speed of light equal to one, this holds for all composite units. I can have any number as unit of space and time as long as they both can be written in form n/m where n, m are natural number and n is less or equal to m- so it do not have to be speed only as natural number of space units divided by time units. But distance between two particles or their interaction length can't be less than one unit of space or time and it always has to be natural number. Goal of quantum gravity is to explain how gravity works on level of elementary particles, here idea is that first i write everything in Planck units, then second i use quantized this way field. Field i will use here is spin number field that takes spin number. I can define antimatter [2] states for sigma states with bar over that states as just normal state but with negative:

$$\overline{\sigma} = -\sigma \tag{1.1}$$

Now i have defined base units and field i will be working with i can move to define equation of motion that govern field. Those equation are second postulate first is quantization of units second is that field does obey field equation. Speed of light limit here does not imply and there are no Lorentz transformation. I will be using as mathematical model connections that are fully define in section field equation. From spin field matrix I can get all Standard Model particles and graviton i don't present other particles that can be create out of spin field matrix.

2. Field equation

Equation of movement in field is second postulate and to create them i need to introduce mathematical objects of field that are connections of field, first i define connection itself for position that can have sixteen direction. I can write that position as $x^{\mu\nu}$ where μ, ν represent direction - first and second one. For now i can write connection field $F^{\mu\nu}$ as:

$$F^{\mu\nu}\left(x^{\mu\nu}\right) := \begin{cases} F^{\mu\nu}\left(x^{\mu\nu}\right) \mapsto \tilde{F}^{\mu\nu}\left(\tilde{x}^{\mu\nu} + x^{\mu\nu}\right) \\ F^{\mu\nu}\left(x^{\mu\nu}\right) = x^{\mu\nu}\left(x^{\mu\nu}\right) \\ \tilde{F}^{\mu\nu}\left(\tilde{x}^{\mu\nu} + x^{\mu\nu}\right) = \tilde{x}^{\mu\nu}\left(\tilde{x}^{\mu\nu} + x^{\mu\nu}\right) \end{cases} \tag{2.1}$$

So it means i take a point of field and move it to another point where one point have one value another one has another- it points in direction but it does not have direction like vectors have. Second thing is that connection of field are not quantum objects- in quantum mechanics i need to have probability number for each possible state. I will use new object that uses connection field i will call it $\Psi_P^{\alpha\beta}$ and its equal to:

$$\sum_P \Psi_P^{\alpha\beta} = \sum_P \frac{\int_{P\in X^4} F^{\mu\nu}\left(x^{\mu\nu}\right) dx^\gamma}{\sum_P \int_{P\in X^4} F^{\mu\nu}\left(x^{\mu\nu}\right) dx^\gamma} F^{\alpha\beta}\left(x^{\alpha\beta} + \sigma_{\alpha\beta} T^{\alpha\beta}\right) \tag{2.2}$$

Where i added two new objects, first one is spin field covariant pseudo tensor $\sigma_{\alpha\beta}$ that gives each direction os spin number and energy contravariant pseudo tensor $T^{\alpha\beta}$. But both of them don't have indexes as field $\mu\nu$ but indexes $\alpha\beta$ those new indexes are rotated in space indexes that i can write for each element of connection field as:

$$x^{\alpha\beta} = \frac{1}{2} R^\alpha_\mu \delta^\beta_\nu x^{\mu\nu} + \frac{1}{2} \delta^\alpha_\mu R^\beta_\nu x^{\mu\nu} \tag{2.3}$$

$$\sigma_{\alpha\beta} T^{\alpha\beta} = \frac{1}{2} \delta^\mu_\alpha \delta^\nu_\beta \sigma_{\mu\nu} R^\alpha_\mu \delta^\beta_\nu T^{\mu\nu} + \frac{1}{2} \delta^\mu_\alpha \delta^\nu_\beta \sigma_{\mu\nu} \delta^\alpha_\mu R^\beta_\nu T^{\mu\nu} \tag{2.4}$$

Where i use rotation operators of normal three dimensions [3] space with no rotation in time direction. In field equation for object $\Psi_P^{\alpha\beta}$ I used integral over whole space X^4 that represents each possible time direction and all possible vectors that can be rotated in space so it generates sphere as space. That equation tells that probability of each path of a field is equal to integral over that path P divided by sum of all integrals over all possible paths. Those equation lack only spin to be complete. I can write rotation angle change for each part of connection field as equal to its value where it does have a base rotation angle but its not affected in change of it:

$$\Delta\theta = 2\pi \sigma_{\mu\nu} T^{\mu\nu} \tag{2.5}$$

3. Energy and simplest solutions

Energy is a scalar, and i can write simple relation between scalar energy and scalar spin number and its tensor parts:

$$\sigma E = \sigma_{\mu\nu} T^{\mu\nu} \tag{3.1}$$

This relation has to be fulfilled. Now i can move to simplest solution for gravity [4] system only, i will use energy written as $\frac{M}{r}$ where M is mass and r is radius, all its written in Planck units so i can write it in normal units as $\frac{Ml_P}{m_P r}$ where subscript P means Planck unit. Graviton has spin two so i have to multiply it by two so i get $\frac{2M}{r}$ i can write now energy relation as:

$$\sigma E = \frac{2Ml_P}{m_P r} = \frac{2M}{r} = \sigma_{\mu\nu} T^{\mu\nu} \tag{3.2}$$

Now i can assume that it does not move in time only in radius direction so i get:

$$\frac{2M}{r} = \sigma_{rr} T^{rr} \tag{3.3}$$

$$0 = \sigma_{tt} T^{tt} = \sigma_{tr} T^{tr} = \sigma_{rt} T^{rt} \tag{3.4}$$

It's easy to see that when i have a photon at event horizon of a black hole it will move foward in time but not move in space so this model predicts correctly for a black hole an event horizon. I can write a state of photon that was emitted to move outside the horizon as:

$$\begin{bmatrix} 1(n) & 0 \\ 0 & 1(n) \end{bmatrix} + \begin{bmatrix} 0 & 0 \\ 0 & -1(n) \end{bmatrix} = \begin{bmatrix} 1(n) & 0 \\ 0 & 0 \end{bmatrix} \tag{3.5}$$

So that photon does not move outside the horizon if it was emitted at some angle it will eventually fall to singularity. Limit of distance between two objects is one it's one Planck length so when i get a photon reach that distance gravity has to repel that photon so it goes back to event horizon and stays- its simplest model of singularity. I can write that state as:

$$\begin{bmatrix} 1(n) & 0 \\ 0 & -1(n) \end{bmatrix} + \begin{bmatrix} 0 & 0 \\ 0 & 2(n) \end{bmatrix} = \begin{bmatrix} 1(n) & 0 \\ 0 & 1(n) \end{bmatrix} \tag{3.6}$$

Where now photon moves first towards the singularity so that's why i have minus sign at rr component. When it goes to event horizon graviton acts on it so it stay at event horizon.

$$\begin{bmatrix} 1(n) & 0 \\ 0 & 1(n) \end{bmatrix} + \begin{bmatrix} 0 & 0 \\ 0 & -1(n) \end{bmatrix} = \begin{bmatrix} 1(n) & 0 \\ 0 & 0 \end{bmatrix} \tag{3.7}$$

4. Spin field matrix

Spin field can be thought as sum of matrix elements. There are two basics states of energy that can describe any system, first one says that zero energy state is equal to zero $E_0 = 0$ so system is massless. Second one says that energy levels are not equal- so system does evolve and have many possible energy states $E_n \neq E_{n-1} ... \neq E_0$. I can write those as states of matrix that has all possible combination of those:

$$S_{nm} = \begin{bmatrix} +s_{11} & +s_{12} \\ -s_{21} & +s_{22} \\ +s_{31} & -s_{32} \\ -s_{41} & -s_{42} \end{bmatrix} \tag{4.1}$$

Where each component of that matrix can have value equal to zero, one or minus one. Sum of those matrix elements is equal to spin state number:

$$\frac{1}{2} \sum_{n,m} S_{nm} = \sigma \tag{4.2}$$

If i have a minus sign of symmetry it means its not fulfilled so the opposite is true, energy zero state is not equal to zero, all energy states are equal. Each elementary particle can be thought as state of that matrix. For example i can write photon and graviton [5] as:

$$\hat{S}_{\gamma} = \begin{bmatrix} 1 & 1 \\ 0 & 0 \\ 0 & 0 \\ 0 & 0 \end{bmatrix} \quad \hat{S}_{G} = \begin{bmatrix} 1 & 1 \\ 0 & 0 \\ 0 & 0 \\ 1 & 1 \end{bmatrix} \tag{4.3}$$

And for each particle there is anti-particle that has opposite state and moves backwards in time compared to normal particle moving foward in time. So for photon and graviton those anti-particles are:

$$\hat{S}_{\overline{\gamma}} = \begin{bmatrix} -1 & -1 \\ 0 & 0 \\ 0 & 0 \\ 0 & 0 \end{bmatrix} \quad \hat{S}_{\overline{G}} = \begin{bmatrix} -1 & -1 \\ 0 & 0 \\ 0 & 0 \\ -1 & -1 \end{bmatrix} \tag{4.4}$$

So anti-photons have mass and only one energy state. Same with anti-gravitons, they have mass and one energy state. But this picture still lacks interaction and energy of that field. I need to define how those states interact. Before i move to it i can write anti-matter state as opposite state of sum of spin field matrix:

$$\overline{\sigma} = -\frac{1}{2} \sum_{n,m} S_{nm} \tag{4.5}$$

5. Spin field interactions

Spin field interactions are just spin matrix elements divided by length of interaction. That is energy of interaction so i get equality between energy and spin and sum of those matrix elements:

$$\sigma E = \frac{1}{2}\sum_{n,m}\frac{S_{nm}}{\Delta x} \tag{5.1}$$

Now for many systems i need to sum each system energy state and their interaction terms. Let's say i have k systems i can write their interaction terms as:

$$\sum_{k,l}\sigma_{kl}E_{kl} = \frac{1}{2}\sum_{k,l}\sum_{n,m}\frac{S_{nmkl}}{\Delta x_{kl}} \tag{5.2}$$

First number k says what system interacts and second number l with what it does. Self interaction terms where $k = l$ are just particles itself. But energy tensor is a tensor so when use summation [6] of it with spin pseudo tensor [7] it is equal to those scalar part created out of spin matrix:

$$\sigma_{\mu\nu}T^{\mu\nu} = \sigma E = \frac{1}{2}\sum_{n,m}\frac{S_{nm}}{\Delta x} \tag{5.3}$$

For many systems i just sum all interaction terms for all particle interaction:

$$\sum_{k,l}\sigma_{\mu\nu kl}T^{\mu\nu}_{kl} = \sum_{k,l}\sigma_{kl}E_{kl} = \frac{1}{2}\sum_{k,l}\sum_{n,m}\frac{S_{nmkl}}{\Delta x_{kl}} \tag{5.4}$$

Energy has to be conserved so here it will manifest that derivative in each direction of sum of all particle interaction is equal to zero-where that derivative has time component and three space components $\partial_\delta = \sum_{\delta=0}^{3}\frac{\partial}{\partial x^\delta}$ (so its not only space components) and field equation for many systems :

$$\partial_\delta\sigma_{\mu\nu}T^{\mu\nu} = \partial_\delta\sigma E = \partial_\delta\frac{1}{2}\sum_{n,m}\frac{S_{nm}}{\Delta x} = 0 \tag{5.5}$$

$$\partial_\delta\sum_{k,l}\sigma_{\mu\nu kl}T^{\mu\nu}_{kl} = \partial_\delta\sum_{k,l}\sigma_{kl}E_{kl} = \partial_\delta\frac{1}{2}\sum_{k,l}\sum_{n,m}\frac{S_{nmkl}}{\Delta x_{kl}} = 0 \tag{5.6}$$

$$\sum_P \Psi^{\alpha\beta}_P = \sum_P \frac{\int_{P\in X^4} F^{\mu\nu}\left(\sum_{k,l} x^{\mu\nu}_{kl}\right)dx^\gamma}{\sum_P\int_{P\in X^4} F^{\mu\nu}\left(\sum_{k,l} x^{\mu\nu}_{kl}\right)dx^\gamma} F^{\alpha\beta}\left(\sum_{k,l} x^{\alpha\beta}_{kl} + \sigma_{\alpha\beta kl}T^{\alpha\beta}_{kl}\right) \tag{5.7}$$

6. Measurement

Measurement is key idea in all physics- in quantum physics measurement [8] change state of wave function from all possible states to one state. Now i can write it all i have wave spin field before measurement and after measurement , where before measurement i sum all paths P after measurement all paths reduce to one path:

$$\sum_P \Psi_P^{\alpha\beta} = \sum_P \frac{\int_{P\in X^4} F^{\mu\nu}\left(x^{\mu\nu}\right) dx^\gamma}{\sum_P \int_{P\in X^4} F^{\mu\nu}\left(x^{\mu\nu}\right) dx^\gamma} F^{\alpha\beta}\left(x^{\alpha\beta} + \sigma_{\alpha\beta} T^{\alpha\beta}\right) \tag{6.1}$$

$$\Psi^{\alpha\beta} = \frac{\int_{P\in X^4} F^{\mu\nu}\left(x^{\mu\nu}\right) dx^\gamma}{\int_{P\in X^4} F^{\mu\nu}\left(x^{\mu\nu}\right) dx^\gamma} F^{\alpha\beta}\left(x^{\alpha\beta} + \sigma_{\alpha\beta} T^{\alpha\beta}\right) \tag{6.2}$$

Now for spin i can have two possible outcomes- positive rotation angle and negative rotation angle that depend on spin matrix state. If term $\sigma_{\mu\nu}T^{\mu\nu}$ is positive so is rotation angle if its negative so is rotation angle. For many particle systems it gets a bit more complex. So for many particle bosons I can write before spin measurement and after, where N is number of all states:

$$\frac{1}{N}\sum_{B=-\sigma_1}^{\sigma_1} \dots \sum_{B=-\sigma_n}^{\sigma_n} \frac{\int_{P\in X^4} F^{\mu\nu}\left(\sum_{k,l} x_{kl}^{\mu\nu}\right) dx^\gamma}{\int_{P\in X^4} F^{\mu\nu}\left(\sum_{k,l} x_{kl}^{\mu\nu}\right) dx^\gamma} F_{B_1\dots B_n}^{\alpha\beta}\left(\sum_{k,l} x_{kl}^{\alpha\beta} + \sigma_{\alpha\beta kl} T_{kl}^{\alpha\beta}\right) \tag{6.3}$$

$$\frac{\int_{P\in X^4} F^{\mu\nu}\left(\sum_{k,l} x_{kl}^{\mu\nu}\right) dx^\gamma}{\int_{P\in X^4} F^{\mu\nu}\left(\sum_{k,l} x_{kl}^{\mu\nu}\right) dx^\gamma} F_{B_1\dots B_n}^{\alpha\beta}\left(\sum_{k,l} x_{kl}^{\alpha\beta} + \sigma_{\alpha\beta kl} T_{kl}^{\alpha\beta}\right) \tag{6.4}$$

Where $B_1..B_n$ after measurement represents one possible state for each particle not sum of all states. Now for fermions [9] I can do same where I sum over states that are not integers, so for example if i have only one half spin number i will sum two states minus one half and plus one half:

$$\frac{1}{N}\sum_{F_1=-\sigma_1\notin Z}^{\sigma_1\notin Z} \dots \sum_{F_n=-\sigma_n\notin Z}^{\sigma_n\notin Z} \frac{\int_{P\in X^4} F^{\mu\nu}\left(\sum_{k,l} x_{kl}^{\mu\nu}\right) dx^\gamma}{\int_{P\in X^4} F^{\mu\nu}\left(\sum_{k,l} x_{kl}^{\mu\nu}\right) dx^\gamma} F_{F_1\dots F_n}^{\alpha\beta}\left(\sum_{k,l} x_{kl}^{\alpha\beta} + \sigma_{\alpha\beta kl} T_{kl}^{\alpha\beta}\right) \tag{6.5}$$

$$\frac{\int_{P\in X^4} F^{\mu\nu}\left(\sum_{k,l} x_{kl}^{\mu\nu}\right) dx^\gamma}{\int_{P\in X^4} F^{\mu\nu}\left(\sum_{k,l} x_{kl}^{\mu\nu}\right) dx^\gamma} F_{F_1\dots F_n}^{\alpha\beta}\left(\sum_{k,l} x_{kl}^{\alpha\beta} + \sigma_{\alpha\beta kl} T_{kl}^{\alpha\beta}\right) \tag{6.6}$$

7. Elementary particles

From spin field matrix I can recover all Standard Model [10] particles and others not predicted by it. First i will list all particles of Standard Model in matter form.

$$H^0 = \begin{bmatrix} -1 & +1 \\ 0 & 0 \\ 0 & 0 \\ -1 & +1 \end{bmatrix} \quad Z^0 = \begin{bmatrix} -1 & -1 \\ 0 & 0 \\ 0 & 0 \\ +1 & -1 \end{bmatrix} \quad W^- = \begin{bmatrix} +1 & -1 \\ -1 & -1 \\ -1 & 0 \\ +1 & 0 \end{bmatrix} \tag{7.1}$$

$$g_1 = \begin{bmatrix} +1 & +1 \\ 0 & 0 \\ 0 & 0 \\ -1 & +1 \end{bmatrix} \quad g_2 = \begin{bmatrix} +1 & +1 \\ 0 & 0 \\ 0 & 0 \\ +1 & -1 \end{bmatrix} \quad g_3 = \begin{bmatrix} +1 & 0 \\ 0 & 0 \\ 0 & 0 \\ +1 & 0 \end{bmatrix} \tag{7.2}$$

$$e^- = \begin{bmatrix} 0 & 0 \\ -1 & +1 \\ -1 & 0 \\ 0 & 0 \end{bmatrix} \quad \mu^- = \begin{bmatrix} 0 & 0 \\ +1 & -1 \\ -1 & 0 \\ 0 & 0 \end{bmatrix} \quad \tau^- = \begin{bmatrix} 0 & 0 \\ -1 & -1 \\ +1 & 0 \\ 0 & 0 \end{bmatrix} \tag{7.3}$$

$$u = \begin{bmatrix} -1 & 0 \\ -1 & +1 \\ 0 & 0 \\ 0 & 0 \end{bmatrix} \quad c = \begin{bmatrix} +1 & 0 \\ -1 & -1 \\ 0 & 0 \\ 0 & 0 \end{bmatrix} \quad t = \begin{bmatrix} -1 & 0 \\ +1 & -1 \\ 0 & 0 \\ 0 & 0 \end{bmatrix} \tag{7.4}$$

$$d = \begin{bmatrix} -1 & 0 \\ -1 & 0 \\ 0 & +1 \\ 0 & 0 \end{bmatrix} \quad s = \begin{bmatrix} +1 & 0 \\ -1 & 0 \\ 0 & -1 \\ 0 & 0 \end{bmatrix} \quad b = \begin{bmatrix} -1 & 0 \\ +1 & 0 \\ 0 & -1 \\ 0 & 0 \end{bmatrix} \tag{7.5}$$

$$\nu_e = \begin{bmatrix} -1 & +1 \\ 0 & 0 \\ 0 & 0 \\ -1 & 0 \end{bmatrix} \quad \nu_\mu = \begin{bmatrix} +1 & -1 \\ 0 & 0 \\ 0 & 0 \\ -1 & 0 \end{bmatrix} \quad \nu_\tau = \begin{bmatrix} -1 & -1 \\ 0 & 0 \\ 0 & 0 \\ +1 & 0 \end{bmatrix} \tag{7.6}$$

$$\gamma = \begin{bmatrix} +1 & +1 \\ 0 & 0 \\ 0 & 0 \\ 0 & 0 \end{bmatrix} \quad G = \begin{bmatrix} +1 & +1 \\ 0 & 0 \\ 0 & 0 \\ +1 & +1 \end{bmatrix} \tag{7.7}$$

Where additional particle here is graviton. Electric charge does work for spin matrix elements $s_{21}, s_{22}, s_{31}, s_{32}$ and its 2/3 for same row entries and 1/3 for row/column mix- where i count each pair as equal to 2/3 or 1/3 charge and it does not matter do they sum to minus two or zero or plus two. If there are mix elements charge is negative is there are only row elements it's positive.

References

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