MINKOWSKI COMPLETE SPACE-TIME ROTATION HYPOTHESIS

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Abstract. This model uses rotation of Minkowski space-time, but assumption is that there can be time flowing in any direction not just in normal time direction, from it comes S tensor field that represents possible states of light cones. From that tensor field I can figure out all elementary particles states that are combination of bosonic fields. Field interactions lead rise to all possible quantum fields.

Contents

1. Minkowski rotated complete space-time

1.1. **Virtual particles and light cones direction.** Light cone direction is always a time direction, but what if there can be not one light cone directions but all four? It extends Minkowski space-time and is key to understanding elementary particles. First let's start with virtual particles. Virtual particle path is shortest part that connects two possible events- not shortest in sense of space-time interval but just a normal straight line in space-time. For two lines (space-time trajectories) that are rotated less or equal to $\frac{\pi}{2}$ radians it's just shortest line in space that does not have a time component. For any other angles virtual particle line is shortest line that connects two points of space-time like it's a not a space-time but just normal space. Let have two space-time points A and B virtual particle line that distance is equal to:

$$ds = \sqrt{\left(cdt_B - cdt_A\right)^2 - \left(dx_B - dx_A\right)^2 + \left(dy_B - dy_A\right)^2 + \left(dz_B - dz_A\right)^2} \tag{1.1}$$

So for particles that interact at same time - virtual particles will interact by line in space only. For example two electrons that emit virtual particle at one point of time will by instant feel it's effects. Now let's go back to light cones direction. Light cone can have four directions in four dimensional space-time as it's time axis. This will lead to eight possible parts of light cone , where I assume that light cone splits in future and past light cone. This can be represented by a matrix with eight scalar functions that represent some field, I will denote this matrix as $S^n_m(\mathbf{x})$ that is matrix in tensor notation, where I use plus sign for future light cone and minus sign for past light cone. I mark each direction by $1, 2, 3, 4$ so i can write this mixed tensor field as:

$$S^n_m(\mathbf{x}) = \begin{pmatrix} S^1_-(\mathbf{x}) & S^1_+(\mathbf{x}) \\ S^2_-(\mathbf{x}) & S^2_+(\mathbf{x}) \\ S^3_-(\mathbf{x}) & S^3_+(\mathbf{x}) \\ S^4_-(\mathbf{x}) & S^4_+(\mathbf{x}) \end{pmatrix} \tag{1.2}$$

Each state of this light cone field represents a physical state of some kind of field. Later on I will explore meaning of this field, but first i need to start with spin.

1.2. **Spin.** Spin is connected to mixed tensor field $S_m^n(\mathbf{x})$, I can calculate for field a spin as half sum of absolute value of sign function of that tensor field:

$$\sigma = \frac{1}{2}\left|\sum_n \sum_m \text{sign}\left(S_m^n(\mathbf{x})\right)\right| \tag{1.3}$$

Spin is number of light cones parts that a given field has, if there are many fields still if each field has one number of light cones those numbers do not sum for each particle field has to give same spin number for each elementary field. Each full light cone gives spin one, so half of light cone gives half spin. Where if that light cone function has positive value at given point it adds to spin, if it has negative value it will be with negative value so it subtracts. I will use rotation tensor that is rotation matrix tensor product with another rotation matrix, first I need to write it, then figure out angles and coordinates [1]:

$$R^{\mu\nu}_{\alpha\beta} = R^{\mu}_{\alpha} \otimes R^{\nu}_{\beta} \tag{1.4}$$

I will use coordinates of light cones that come from $S_m^n(\mathbf{x})$ tensor. I will denote those coordinates as that matrix elements. I will write angle dependence of those rotation matrix as, where subscript numbers means rotated axis that are six for four dimensional space-time $(12, 13, 14, 42, 43, 23)$ i only write first axis :

$$R^{\mu}_{\alpha}\left(\boldsymbol{\Theta}\left(\mathbf{x}^n_m\right)\right) = \sum_{i_1,\ldots,i_{2\sigma}} R^{\mu}_{\alpha}\left(\frac{1}{2}\left(\theta_{12i_1}\left(\mathbf{x}^1_-\right) \ldots + \theta_{12i_{2\sigma}}\left(\mathbf{x}^4_+\right)\right), \ldots\right) \tag{1.5}$$

For making this notation shorter i will just write rotation matrix as $R^{\mu}_{\alpha}\left(\boldsymbol{\Theta}\left(\mathbf{x}^n_m\right)\right)$ where it's equal to equation 1.8. Summation represents each possible rotation angle that system can have. For each spin there can be twice times rotation angles for each spin part. It means that state of rotation matrix is not a single rotation angle but sum of all possible rotation angles. For each light cone there is rotation by half angle, so it sums to rotation by spin number angle as rotation that is full angle rotation. Coordinates are divided by what light cones part is used, for each rotation angle there is dependence only on one part of light cone that is one part of $S_m^n(\mathbf{x})$ tensor. It means that each part of rotation angle is matched with each part of $S_m^n(\mathbf{x})$ tensor field components.

1.3. **Rotated Minkowski space-time.** From spin I can move to rotating a Minkowski space-time [2], first I write rotation of that space-time:

$$ds^2 = \eta_{\mu\nu} R^{\mu}_{\alpha}\left(\mathbf{\Theta}\left(\mathbf{x}^n_m\right)\right) \otimes R^{\nu}_{\beta}\left(\mathbf{\Theta}\left(\mathbf{x}^n_m\right)\right) dx^{\alpha} dx^{\beta} \tag{1.6}$$

Now i need to add probability for each rotation. If i denote probability of rotation as $\rho^2(n)$:

$$ds^2 = \sum_n \rho^2(n)\, \eta_{\mu\nu} R^{\mu}_{\alpha}\left(\mathbf{\Theta}\left(\mathbf{x}^n_m\right)\right) \otimes R^{\nu}_{\beta}\left(\mathbf{\Theta}\left(\mathbf{x}^n_m\right)\right) dx^{\alpha} dx^{\beta} \tag{1.7}$$

Now I have half of equation, next half will change rotation mixed tensor into change of sum, of $S^n_m(\mathbf{x})$ tensor field components. I can write that new mixed tensor field as:

$$F^{\mu\nu}_{\alpha\beta}(\mathbf{x}) = \partial_{\alpha} \sum_m \delta^{\mu}_n S^n_m(\mathbf{x}) \otimes \partial_{\beta} \sum_l \delta^{\nu}_k S^k_l(\mathbf{x}) \tag{1.8}$$

For each field there is one of those tensor fields. So for each particle there are five fields of $S^n_m(\mathbf{x})$ tensor field. Now I can write full field equality:

$$\begin{aligned} ds^2 &= \sum_n \rho^2(n)\, \eta_{\mu\nu} R^{\mu}_{\alpha}\left(\mathbf{\Theta}\left(\mathbf{x}^n_m\right)\right) \otimes R^{\nu}_{\beta}\left(\mathbf{\Theta}\left(\mathbf{x}^n_m\right)\right) dx^{\alpha} dx^{\beta} \\ &= \sum_n \rho^2(n)\, \eta_{\mu\nu} F^{\mu\nu}_{\alpha\beta}(\mathbf{x})\, dx^{\alpha} dx^{\beta} \end{aligned} \tag{1.9}$$

When i do measurement all probability numbers go to zero and one that was measured goes to one. Where number n is number of all space-time points involved in final state. So more rotations state consists of less probability of it. I can denote field itself not metric part as:

$$\begin{aligned} \Psi^{\mu\nu} &= \int \sum_n \rho^2(n)\, R^{\mu}_{\alpha}\left(\mathbf{\Theta}\left(\mathbf{x}^n_m\right)\right) \otimes R^{\nu}_{\beta}\left(\mathbf{\Theta}\left(\mathbf{x}^n_m\right)\right) dx^{\alpha} dx^{\beta} \\ &= \int \sum_n \rho^2(n)\, F^{\mu\nu}_{\alpha\beta}(\mathbf{x})\, dx^{\alpha} dx^{\beta} \end{aligned} \tag{1.10}$$

1.4. **Rotated light cone.** For each observer it's casual structure is build upon it's light cones. Light cones rotate with angle equal to rotation of given field part. I can write it as equation of light cone:

$$\eta_{\mu\nu}R^{\mu}_{\alpha}\left(\mathbf{\Theta}\left(\mathbf{x}^{n}_{m}\right)\right)\otimes R^{\nu}_{\beta}\left(\mathbf{\Theta}\left(\mathbf{x}^{n}_{m}\right)\right)dx^{\alpha}dx^{\beta}=0 \tag{1.11}$$

Where rotation is equal to solution to field equation. I can write full field equation being equal to zero as:

$$\begin{aligned} ds^{2} &= \sum_{n}\rho^{2}\left(n\right)\eta_{\mu\nu}R^{\mu}_{\alpha}\left(\mathbf{\Theta}\left(\mathbf{x}^{n}_{m}\right)\right)\otimes R^{\nu}_{\beta}\left(\mathbf{\Theta}\left(\mathbf{x}^{n}_{m}\right)\right)dx^{\alpha}dx^{\beta} \\ &= \sum_{n}\rho^{2}\left(n\right)\eta_{\mu\nu}F^{\mu\nu}_{\alpha\beta}\left(\mathbf{x}\right)dx^{\alpha}dx^{\beta}=0 \end{aligned} \tag{1.12}$$

But all observers need to see speed of light as constant what about speed of light for rotated observer and non rotated one? There is need for transformations that conserve speed of light, those transformation need to obey [3]:

$$\begin{aligned} &\eta_{\mu\nu}R^{\mu}_{\alpha}\left(\mathbf{\Theta}\left(\mathbf{x}^{n}_{m}\right)\right)\otimes R^{\nu}_{\beta}\left(\mathbf{\Theta}\left(\mathbf{x}^{n}_{m}\right)\right)dx^{\alpha}dx^{\beta} \\ &= \eta_{\mu\nu}R^{\mu'}_{\alpha}\left(\mathbf{\Theta}\left(\mathbf{x}^{n}_{m}\right)\right)\otimes R^{\nu'}_{\beta}\left(\mathbf{\Theta}\left(\mathbf{x}^{n}_{m}\right)\right)dx^{\alpha'}dx^{\beta'} \end{aligned} \tag{1.13}$$

So they conserve speed of light being same for all rotated frame of reference. Massive particles move only in time axis so I can reduce their equation to:

$$\begin{aligned} ds^{2} &= \sum_{n}\rho^{2}\left(n\right)\eta_{\mu\nu}R^{\mu}_{0}\left(\mathbf{\Theta}\left(\mathbf{x}^{n}_{m}\right)\right)\otimes R^{\nu}_{0}\left(\mathbf{\Theta}\left(\mathbf{x}^{n}_{m}\right)\right)\left(dx^{0}\right)^{2} \\ &= \sum_{n}\rho^{2}\left(n\right)\eta_{\mu\nu}F^{\mu\nu}_{00}\left(\mathbf{x}\right)\left(dx^{0}\right)^{2} \end{aligned} \tag{1.14}$$

For for massive particles this equality is simpler:

$$\begin{aligned} &\eta_{\mu\nu}R^{\mu}_{0}\left(\mathbf{\Theta}\left(\mathbf{x}^{n}_{m}\right)\right)\otimes R^{\nu}_{0}\left(\mathbf{\Theta}\left(\mathbf{x}^{n}_{m}\right)\right)dx^{0}dx^{0} \\ &= \eta_{\mu\nu}R^{\mu'}_{0}\left(\mathbf{\Theta}\left(\mathbf{x}^{n}_{m}\right)\right)\otimes R^{\nu'}_{0}\left(\mathbf{\Theta}\left(\mathbf{x}^{n}_{m}\right)\right)dx^{0'}dx^{0'} \end{aligned} \tag{1.15}$$

So massive particles only differ by time axis.

2. Elementary fields

2.1. **Virtual bosonic fields.** There are five elementary bosonic fields [4], I will write them in matrix form as spin components without sum so each matrix will be equal to $\hat{\sigma} = \frac{1}{2}\left|\operatorname{sign}\left(S_m^n\left(\mathbf{x}\right)\right)\right|$: First I write Higgs virtual field as and photonic field as one for each axis where I write only for first axis states:

$$\hat{\sigma}_{\tilde{H}^0} = \begin{bmatrix} -\frac{1}{2} & +\frac{1}{2} \\ 0 & 0 \\ 0 & 0 \\ 0 & 0 \end{bmatrix} \qquad \hat{\sigma}_{\tilde{\gamma}} = \begin{bmatrix} \frac{1}{2} & \frac{1}{2} \\ 0 & 0 \\ 0 & 0 \\ 0 & 0 \end{bmatrix} \tag{2.1}$$

Now graviton virtual field- that has more states, three:

$$\hat{\sigma}_{\tilde{G}} = \begin{bmatrix} \frac{1}{2} & \frac{1}{2} \\ \frac{1}{2} & \frac{1}{2} \\ 0 & 0 \\ 0 & 0 \end{bmatrix} \qquad \begin{bmatrix} \frac{1}{2} & \frac{1}{2} \\ 0 & 0 \\ \frac{1}{2} & \frac{1}{2} \\ 0 & 0 \end{bmatrix} \qquad \begin{bmatrix} \frac{1}{2} & \frac{1}{2} \\ 0 & 0 \\ 0 & 0 \\ \frac{1}{2} & \frac{1}{2} \end{bmatrix} \tag{2.2}$$

Now i move to strong virtual field and six for each axis states of gluons, where i write first three and rest is all combination of them that gives total twenty four:

$$\hat{\sigma}_{\tilde{g}} = \begin{bmatrix} \frac{1}{2} & \frac{1}{2} \\ \frac{1}{2} & \frac{1}{2} \\ -\frac{1}{2} & -\frac{1}{2} \\ 0 & 0 \end{bmatrix} \qquad \begin{bmatrix} \frac{1}{2} & \frac{1}{2} \\ 0 & 0 \\ \frac{1}{2} & \frac{1}{2} \\ -\frac{1}{2} & -\frac{1}{2} \end{bmatrix} \qquad \begin{bmatrix} \frac{1}{2} & \frac{1}{2} \\ \frac{1}{2} & \frac{1}{2} \\ 0 & 0 \\ -\frac{1}{2} & -\frac{1}{2} \end{bmatrix} \tag{2.3}$$

And as last i get W and Z bosons so weak virtual force, where again I write only three states rest are combination of them so both give total twelve states for Z boson and twenty-four for W boson:

$$\hat{\sigma}_{\tilde{Z}} = \begin{bmatrix} \frac{1}{2} & \frac{1}{2} \\ +\frac{1}{2} & -\frac{1}{2} \\ 0 & 0 \\ 0 & 0 \end{bmatrix} \qquad \begin{bmatrix} \frac{1}{2} & \frac{1}{2} \\ 0 & 0 \\ +\frac{1}{2} & -\frac{1}{2} \\ 0 & 0 \end{bmatrix} \qquad \begin{bmatrix} \frac{1}{2} & \frac{1}{2} \\ 0 & 0 \\ 0 & 0 \\ +\frac{1}{2} & -\frac{1}{2} \end{bmatrix} \tag{2.4}$$

$$\hat{\sigma}_{\tilde{W}} = \begin{bmatrix} \frac{1}{2} & \frac{1}{2} \\ \frac{1}{2} & \frac{1}{2} \\ -\frac{1}{2} & -\frac{1}{2} \\ -\frac{1}{2} & +\frac{1}{2} \end{bmatrix} \qquad \begin{bmatrix} \frac{1}{2} & \frac{1}{2} \\ -\frac{1}{2} & +\frac{1}{2} \\ \frac{1}{2} & \frac{1}{2} \\ -\frac{1}{2} & -\frac{1}{2} \end{bmatrix} \qquad \begin{bmatrix} \frac{1}{2} & \frac{1}{2} \\ \frac{1}{2} & \frac{1}{2} \\ -\frac{1}{2} & +\frac{1}{2} \\ -\frac{1}{2} & -\frac{1}{2} \end{bmatrix} \tag{2.5}$$

From three base fields, Higgs field , photonic field and gravity field I can build rest fields as combination of them, where im allowed to use anti-fields of those base fields.

2.2. **Real quark fields.** From virtual bosonic fields I can create real particle states. All quarks have spin half so I will take only states of those fields that gives spin one half. For any axis a I can write general quarks states:

$$\hat{\sigma}_i^{a_{1/2}} = \hat{\sigma}_{\tilde{H}_a^0}^{a_{1/2}} + \hat{\sigma}_{\tilde{\gamma}_a}^{a_{1/2}} + \hat{\sigma}_{\tilde{G}_i}^{a_{1/2}} + \hat{\sigma}_{\tilde{W}_i^+}^{a_{1/2}} + \hat{\sigma}_{\tilde{Z}_i^0}^{a_{1/2}} + \frac{1}{\sqrt{2}}\left(\hat{\hat{\sigma}}_{\tilde{g}_i}^{a_{1/2}} + \hat{\hat{\sigma}}_{\bar{\tilde{g}}_i}^{a_{1/2}}\right) \tag{2.6}$$

$$\hat{\sigma}_j^{a_{1/2}} = \hat{\sigma}_{\tilde{H}_a^0}^{a_{1/2}} + \hat{\sigma}_{\tilde{\gamma}_a}^{a_{1/2}} + \hat{\sigma}_{\tilde{G}_j}^{a_{1/2}} + \hat{\sigma}_{\tilde{W}_j^-}^{a_{1/2}} + \hat{\sigma}_{\tilde{Z}_j^0}^{a_{1/2}} + \frac{1}{\sqrt{2}}\left(\hat{\hat{\sigma}}_{\tilde{g}_j}^{a_{1/2}} + \hat{\hat{\sigma}}_{\bar{\tilde{g}}_j}^{a_{1/2}}\right) \tag{2.7}$$

So quarks interact by all fields, I used subscript with number that represents I take only component of $S_m^n(\mathbf{x})$ tensor field that give value one half in this matrix. Strong interaction consists of gluon-antigluon pair interaction where I represent antigluon by bar notation. In general antifield is just a field with all signs reversed [5]:

$$S_m^n(\mathbf{x}) = -\overline{S}_m^n(\mathbf{x}) \tag{2.8}$$

It means that all light cones directions are reversed. That field represents antimatter. I did use two indexes i and j that represents both particles and possible states of virtual fields. First one gives all quarks that have electric charge two thirds, and second one- one third. Both indexes run from one to three but i distinct them for masses of quarks are not the same.

2.3. **Rest of lepton family fields.** Now I can move to rest of lepton family of particles. I start with electron, moun and tau, then with neutrinos. All of those fermions follow simple rule, quarks interact with all fields. Electron, moun and tau with all fields without strong one, neutrinos all without strong and photonic and finally last dark matter particles only interact by Higgs field and gravity. But still there is one part lacking in electron, moun and tau family. And one lacking in neutrinos family. If this thinking is correct there could be three more neutrinos and three more charged particles with positive charge. First I write know leptons:

$$\hat{\sigma}_i^{a_{1/2}} = \hat{\sigma}_{\tilde{H}_a^0}^{a_{1/2}} + \hat{\sigma}_{\tilde{\gamma}_a}^{a_{1/2}} + \hat{\sigma}_{\tilde{G}_i}^{a_{1/2}} + \hat{\sigma}_{\tilde{W}_i^-}^{a_{1/2}} + \hat{\sigma}_{\tilde{Z}_i^0}^{a_{1/2}} \tag{2.9}$$

$$\hat{\sigma}_j^{a_{1/2}} = \hat{\hat{\sigma}}_{\tilde{H}_a^0}^{a_{1/2}} + \hat{\hat{\sigma}}_{\tilde{G}_j}^{a_{1/2}} + \hat{\sigma}_{\tilde{W}_j^+}^{a_{1/2}} + \hat{\sigma}_{\tilde{Z}_j^0}^{a_{1/2}} \tag{2.10}$$

Now I can write those additional ones that could come out of this reasoning:

$$\hat{\sigma}_k^{a_{1/2}} = \hat{\sigma}_{\tilde{H}_a^0}^{a_{1/2}} + \hat{\sigma}_{\tilde{\gamma}_a}^{a_{1/2}} + \hat{\sigma}_{\tilde{G}_k}^{a_{1/2}} + \hat{\sigma}_{\tilde{W}_k^+}^{a_{1/2}} + \hat{\sigma}_{\tilde{Z}_k^0}^{a_{1/2}} \tag{2.11}$$

$$\hat{\sigma}_l^{a_{1/2}} = \hat{\hat{\sigma}}_{\tilde{H}_a^0}^{a_{1/2}} + \hat{\hat{\sigma}}_{\tilde{G}_l}^{a_{1/2}} + \hat{\sigma}_{\tilde{W}_l^-}^{a_{1/2}} + \hat{\sigma}_{\tilde{Z}_l^0}^{a_{1/2}} \tag{2.12}$$

I use indexes k and l to distinct them from know leptons. They would vary by mass, and for electric charged particles by charge. Now last left particles are candidate for dark matter in this model, last particles of this ladder, that interact only by gravity and Higgs field. There would be only three of them it comes from fact that there is only three states of gravity virtual field. They would be spin one half, so I can write them as:

$$\hat{\sigma}_i^{a_{1/2}} = \hat{\sigma}_{\tilde{H}_a^0}^{a_{1/2}} + \hat{\sigma}_{\tilde{G}_i}^{a_{1/2}} \tag{2.13}$$

2.4. **Real bosonic fields.** I presented virtual bosonic fields, but there are real ones. Higgs boson will interact not only with gravity virtual field but with antigravity field to sum up give zero spin. Photon will only interact with gravity field. Same as graviton but their spin states possible will be not the same. Gluons will interact with gluon field and gravity field. More complex are weak force real particles, W bosons interact with Higgs, gravity, photonic and themself. Z boson with Higgs, gravity and itself. I can write all this as before :

$$\hat{\sigma}^{a_0}_{H^0_i} = \hat{\sigma}^{a_0}_{\tilde{H}^0_a} + \frac{1}{\sqrt{2}}\left(\hat{\sigma}^{a_+}_{\tilde{G}_a} + \hat{\sigma}^{a_-}_{\tilde{G}_a}\right) \tag{2.14}$$

$$\hat{\sigma}^{a_1}_{\gamma_i} = \hat{\sigma}^{a_1}_{\tilde{G}_i} \tag{2.15}$$

$$\hat{\sigma}^{a_2}_{G_i} = \hat{\sigma}^{a_2}_{\tilde{G}_i} \tag{2.16}$$

$$\hat{\sigma}^{a_1}_{g_i} = \hat{\sigma}^{a_1}_{\tilde{G}_i} + \hat{\sigma}^{a_1}_{\tilde{g}_i} \tag{2.17}$$

$$\hat{\sigma}^{a_1}_{W^+_i} = \hat{\sigma}^{a_1}_{\tilde{H}^0_a} + \hat{\sigma}^{a_1}_{\tilde{G}_i} + \hat{\sigma}^{a_1}_{\tilde{\gamma}_a} + \hat{\sigma}^{a_1}_{\tilde{W}^+_i} \tag{2.18}$$

$$\hat{\sigma}^{a_1}_{W^-_i} = \hat{\sigma}^{a_1}_{\tilde{H}^0_a} + \hat{\sigma}^{a_1}_{\tilde{G}_i} + \hat{\sigma}^{a_1}_{\tilde{\gamma}_a} + \hat{\sigma}^{a_1}_{\tilde{W}^-_i} \tag{2.19}$$

$$\hat{\sigma}^{a_1}_{Z^0_i} = \hat{\sigma}^{a_1}_{\tilde{H}^0_a} + \hat{\sigma}^{a_1}_{\tilde{G}_i} + \hat{\sigma}^{a_1}_{\tilde{Z}_i} \tag{2.20}$$

Now I have all possible real and virtual fields. From it I can move to their interactions and quantities that are conserved in those interactions. In all possible interactions of field conserved quantity is fields itself. For example if electron and positron collide and as result I will get two photons all fields go to zero and only photonic fields stays this can be written as sum of all fields and anti-fields giving zero but not the photonic field so as result I will get photons.

3. Elementary fields interactions

3.1. **Field interactions.** Key idea is how fields interact between themself. There are five fundamental fields so I need to calculate five parts of $S_m^n(\mathbf{x})$ tensor field. That field will have two parts, first is just normal particles fields and their interactions and virtual particle field and its interactions. I will start by adding new object tensor field $I_{mp}^{nq}(\mathbf{x})$ that is interaction term that can have value from one to minus one. It transforms given part of field where it acts as interaction between two fields at given point of space-time. It can be self field interaction too, field itself consist of infinite number of connections at each point of that field. That connections represent interactions or possible paths that field can take. To create an equation for all possible field interaction i will start with another function, let's say i have a point of space-time $\mathbf{x}_i$ and another point $\mathbf{x}_j$ I will denote vector from i to j as $\mathbf{x}_{ij}$ now form it I can create a new function that transforms that vector into new vector, so it leads from one vector to another, this function will be written as $\mathbf{x}_{kl}\left(\mathbf{x}_{ij}\right)$ in this case i go from i to j and from j to k then from k to l. But this function can have more than one vector as input or output. Let's say I have two vectors and I transform them into one: $\mathbf{x}_{rs}\left(\mathbf{x}_{kl};\mathbf{x}_{ij}\right)$ now i go from both vectors to vector $\mathbf{x}_{rs}$, so I go from i to j from j to r from r to s and I go from k to l from l to r from r to s. This function is not interchangeable, $\mathbf{x}_{rs}\left(\mathbf{x}_{kl};\mathbf{x}_{ij}\right) \neq \mathbf{x}_{kl};\mathbf{x}_{ij}\left(\mathbf{x}_{rs}\right)$, now when I have those two functions defined I can move to creating a field equation. Let's say I have a series of points of space-time $i, j, ..., N, M$ and each of them have subindex representing each of five fundamental fields $i_1, ..., i_5, j_1, ..., j_5..., N_1, ..., N_5, M_1..., M_5$, first i sum real fields, where I take function of field in each fo those space-time points. Then I move to interaction terms, first I sum only one vector to one vector field interactions, then two to one and so on. I sum all possible fields from one to five in this, then I virtual fields so i repeat this procedure. I can write field equation 1.3 on next page, this field equation adds very important concept, interaction tensor, that will play crucial role in explain how fields change one to another. It's value can be only from one to minus one, where one means that field with another field or with itself for given part of $S_m^n(\mathbf{x})$ tensor fields gives full positive interaction. Or it's minus one for full negative interaction or some interaction that is not fully negative or positive.

$$
\begin{aligned}
S_m^n(\mathbf{x}) = \sum_{i_1\neq j_1}\sum_{j_1\neq i_1}\cdots\sum_{N_1\neq M_1}\sum_{M_1\neq N_1}\cdots\sum_{i_5\neq j_5}\sum_{j_5\neq i_5}\cdots\sum_{N_5\neq M_5}\sum_{M_5\neq N_5} \\
S_m^n(\mathbf{x}_{i_1})\ldots.+S_m^n(\mathbf{x}_{i_5})+\ldots S_m^n(\mathbf{x}_{M_1})\ldots.+S_m^n(\mathbf{x}_{M_5}) \\
+I_{mp}^{nq}\left(\mathbf{x}_{i_1j_1}(\mathbf{x}_{k_1l_1})\right)S_q^p\left(\mathbf{x}_{i_1j_1}(\mathbf{x}_{k_1l_1})\right)\ldots \\
+I_{mp}^{nq}\left(\mathbf{x}_{(N-1)_1(M-1)_1}(\mathbf{x}_{N_1M_1})\right)S_q^p\left(\mathbf{x}_{(N-1)_1(M-1)_1}(\mathbf{x}_{N_1M_1})\right) \\
\ldots+I_{mp}^{nq}\left(\mathbf{x}_{i_5j_5}(\mathbf{x}_{k_5l_5})\right)S_q^p\left(\mathbf{x}_{i_5j_5}(\mathbf{x}_{k_5l_5})\right)\ldots \\
+I_{mp}^{nq}\left(\mathbf{x}_{(N-1)_1(M-1)_1}(\mathbf{x}_{N_5M_5})\right)S_q^p\left(\mathbf{x}_{(N-1)_5(M-1)_5}(\mathbf{x}_{N_5M_5})\right) \\
+I_{mp}^{nq}\left(\mathbf{x}_{i_1j_1};\mathbf{x}_{k_1l_1}(\mathbf{x}_{r_1s_1};\mathbf{x}_{w_1h_1})\right)S_q^p\left(\mathbf{x}_{i_1j_1};\mathbf{x}_{k_1l_1}(\mathbf{x}_{r_1s_1};\mathbf{x}_{w_1h_1})\right)\ldots \\
+I_{mp}^{nq}\left(\mathbf{x}_{(N-3)_1(M-3)_1};\mathbf{x}_{(N-2)_1(M-2)_1}\left(\mathbf{x}_{(N-1)_1(M-1)_1};\mathbf{x}_{N_1M_1}\right)\right) \\
\times S_q^p\left(\mathbf{x}_{(N-3)_1(M-3)_1};\mathbf{x}_{(N-2)_1(M-2)_1}\left(\mathbf{x}_{(N-1)_1(M-1)_1};\mathbf{x}_{N_1M_1}\right)\right) \\
\ldots+I_{mp}^{nq}\left(\mathbf{x}_{i_5j_5};\mathbf{x}_{k_5l_5}(\mathbf{x}_{r_5s_5};\mathbf{x}_{w_5h_5})\right)S_q^p\left(\mathbf{x}_{i_5j_5};\mathbf{x}_{k_5l_5}(\mathbf{x}_{r_5s_5};\mathbf{x}_{w_5h_5})\right)\ldots \\
+I_{mp}^{nq}\left(\mathbf{x}_{(N-3)_5(M-3)_5};\mathbf{x}_{(N-2)_5(M-2)_5}\left(\mathbf{x}_{(N-1)_5(M-1)_5};\mathbf{x}_{N_5M_5}\right)\right) \\
\times S_q^p\left(\mathbf{x}_{(N-3)_5(M-3)_5};\mathbf{x}_{(N-2)_5(M-2)_5}\left(\mathbf{x}_{(N-1)_5(M-1)_5};\mathbf{x}_{N_5M_5}\right)\right)\ldots \\
\tilde{S}_m^n\left(\mathbf{x}_{i_1j_1}\right)\ldots.+\tilde{S}_m^n\left(\mathbf{x}_{i_5j_5}\right)+\ldots\tilde{S}_m^n\left(\mathbf{x}_{N_1M_1}\right) \\
+\tilde{I}_{mp}^{nq}\left(\mathbf{x}_{i_1j_1}(\mathbf{x}_{k_1l_1})\right)\tilde{S}_q^p\left(\mathbf{x}_{i_1j_1}(\mathbf{x}_{k_1l_1})\right)\ldots \\
+\tilde{I}_{mp}^{nq}\left(\mathbf{x}_{(N-1)_1(M-1)_1}(\mathbf{x}_{N_1M_1})\right)\tilde{S}_q^p\left(\mathbf{x}_{(N-1)_1(M-1)_1}(\mathbf{x}_{N_1M_1})\right) \\
\ldots+\tilde{I}_{mp}^{nq}\left(\mathbf{x}_{i_5j_5}(\mathbf{x}_{k_5l_5})\right)\tilde{S}_q^p\left(\mathbf{x}_{i_5j_5}(\mathbf{x}_{k_5l_5})\right)\ldots \\
+\tilde{I}_{mp}^{nq}\left(\mathbf{x}_{(N-1)_1(M-1)_1}(\mathbf{x}_{N_5M_5})\right)\tilde{S}_q^p\left(\mathbf{x}_{(N-1)_5(M-1)_5}(\mathbf{x}_{N_5M_5})\right) \\
+\tilde{I}_{mp}^{nq}\left(\mathbf{x}_{i_1j_1};\mathbf{x}_{k_1l_1}(\mathbf{x}_{r_1s_1};\mathbf{x}_{w_1h_1})\right)\tilde{S}_q^p\left(\mathbf{x}_{i_1j_1};\mathbf{x}_{k_1l_1}(\mathbf{x}_{r_1s_1};\mathbf{x}_{w_1h_1})\right)\ldots \\
+\tilde{I}_{mp}^{nq}\left(\mathbf{x}_{(N-3)_1(M-3)_1};\mathbf{x}_{(N-2)_1(M-2)_1}\left(\mathbf{x}_{(N-1)_1(M-1)_1};\mathbf{x}_{N_1M_1}\right)\right) \\
\tilde{\times} S_q^p\left(\mathbf{x}_{(N-3)_1(M-3)_1};\mathbf{x}_{(N-2)_1(M-2)_1}\left(\mathbf{x}_{(N-1)_1(M-1)_1};\mathbf{x}_{N_1M_1}\right)\right) \\
\ldots+\tilde{I}_{mp}^{nq}\left(\mathbf{x}_{i_5j_5};\mathbf{x}_{k_5l_5}(\mathbf{x}_{r_5s_5};\mathbf{x}_{w_5h_5})\right)\tilde{S}_q^p\left(\mathbf{x}_{i_5j_5};\mathbf{x}_{k_5l_5}(\mathbf{x}_{r_5s_5};\mathbf{x}_{w_5h_5})\right)\ldots \\
\tilde{+} I_{mp}^{nq}\left(\mathbf{x}_{(N-3)_5(M-3)_5};\mathbf{x}_{(N-2)_5(M-2)_5}\left(\mathbf{x}_{(N-1)_5(M-1)_5};\mathbf{x}_{N_5M_5}\right)\right) \\
\times\tilde{S}_q^p\left(\mathbf{x}_{(N-3)_5(M-3)_5};\mathbf{x}_{(N-2)_5(M-2)_5}\left(\mathbf{x}_{(N-1)_5(M-1)_5};\mathbf{x}_{N_5M_5}\right)\right)\ldots \qquad (3.1)
\end{aligned}
$$

3.2. **Probability of field interactions.** Each interaction of field has a probability of it, in chapter about Minkowski space-time rotations i wrote them as function squared for each possible rotation. Idea behind each probability is simple, each process of field interaction has probability proportional to inverse number of all possible way an interaction for given number of space-time points can take place. I can put in equation as:

$$\rho(n) = \frac{1}{(\frac{1}{2}n(n-1))^2 + \frac{1}{2}n(n-1)}\left[\frac{1}{\sum_{n=2}^{k}(\frac{1}{2}n(n-1))^2 + \frac{1}{2}n(n-1)}\right]^{-1} \tag{3.2}$$

If there is a process that consists of n possible space-time points it's probability is equal to that function, so probability squared is just that function squared. Now I need to connect that function to number of points that field has. So number k is just all possible connections all points involved in interaction has:

$$k = \frac{n\,(n-1)}{2} \tag{3.3}$$

But points can move in two ways, I can connect them from one point to another and opposite way. So direction is two way, so final answer is without that division by two:

$$\rho(n) = \frac{1}{(n(n-1))^2 + n(n-1)}\left[\frac{1}{\sum_{n=2}^{k}(n(n-1))^2 + n(n-1)}\right]^{-1} \tag{3.4}$$

Or I can split that probability into field and anti-field part, when anti-field will move backward compared to field:

$$\rho\,(n) = \frac{1}{(\frac{1}{2}n(n-1))^2 + \frac{1}{2}n(n-1)}\left[\frac{1}{\sum_{n=2}^{k}(\frac{1}{2}n(n-1))^2 + \frac{1}{2}n(n-1)}\right]^{-1} \tag{3.5}$$

$$\overline{\rho}\,(n) = \frac{1}{(\frac{1}{2}n(n-1))^2 + \frac{1}{2}n(n-1)}\left[\frac{1}{\sum_{n=2}^{k}(\frac{1}{2}n(n-1))^2 + \frac{1}{2}n(n-1)}\right]^{-1} \tag{3.6}$$

From it follows that field and anti-field probabilities are equal.

3.3. **Energy relation with field.** Last part of field it's relation with energy for massive and massless particles. There is connection between those two, for simplest case scenario of single rotation with energy acting on both directions of rotation I can write equation and for massive particles:

$$ds^2 = \left(\cos^2(\theta) - \sin^2(\theta)\right)\left(dx^0\right)^2 = \left(dx^0\right)^2\left(1 - 2\left(\frac{E_0^2}{E^2} + E_0^2\right)\right) \tag{3.7}$$

Where zero energy is just mass. For massless particles it's more complex. In simplest case scenario I can write this equation as:

$$ds^2 = \left(\cos(\theta)\, ct - \sin(\theta)\, x\right)^2 - \left(\cos(\theta)\, x + \sin(\theta)\, ct\right)^2$$
$$= -c^2t^2E^2 + c^2t^2\left(1 - E^2\right) - 4ctx\left(\sqrt{1 - E^2}E\right) + x^2E^2 - x^2\left(1 - E^2\right) \tag{3.8}$$

So for each rotation with energy E for massive particles for sine function I will get term $\sqrt{\frac{E_0^2}{E^2} + E_0^2}$ for each cosine I will get term $\sqrt{1 - \frac{E_0^2}{E^2} + E_0^2}$ for massless particles it just E for each sine and $\sqrt{1 - E^2}$ for each cosine function. Those equation for massive particles are set this way that for Planck energy speed gets to one so to speed of light. I can write relation between energy for massive and massless particles when for example a massive particle turns into massless or the opposite:

$$\Phi^2 = \frac{E_0^2}{E^2} + E_0^2 \tag{3.9}$$

$$1 - \Phi^2 = 1 - \frac{E_0^2}{E^2} + E_0^2 \tag{3.10}$$

Where i wrote massless particles energy as Φ.

References

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