SYMMETRY AND SIMPLEST QUANTUM FIELD GRAVITY IDEA

TOMASZ KOBIERZYCKI
SHIZYKFIZYK@GMAIL.COM

Abstract. In this paper [1] i will present simplest possible quantum gravity. It has spin and replace Standard Model particles with symmetries. This model can explain all Standard Model particles using symmetry and it can predict existence of new ones that are: anti-photon, anti-graviton, anti-gluon and graviton, first three are so called dark matter particles in this model, they interact only by gravity. Workings of particle interaction here are very close to standard model, symmetry is exchanged (in SM its virtual force particle) that leads to change of energy state of particles interacting. Real force caring particles are created where there is change in field energy of particles so real force caring boson is created that takes energy. Where there is no real force caring bosons- symmetry exchange takes over virtual particle exchange in Standard Model. Many systems equation does not use one vector spin states but a tensor that is interaction of them it comes from a fact that its interaction of two systems- from it entanglement states can be created. And as final word measurement changes particle state to be at one point but only for Planck time, then it spread for whole space-time again. But change in energy states in not instant it comes from fact of interaction time, longer it is longer it takes to change state of particle, particle is at some energy state for short time then for short time it is in that state again and so on, if energy is low its change time is shorter but it last longer so it is in one energy state for longer- interaction time and time in of being in state are opposites.

1. Basic units

In this whole paper i will be using basic Plancks units, of energy, time , space and momentum. It means i can write any unit as $U = \frac{U_B}{U_P}$, where U is the unit used in theory and U_B, U_P are base units and Planck units. There can't be less than one unit of distance and time, so it means that objects that move less than Planck length in one Planck time will move eventually by Planck length when enough of time passes. It means change in position Δx and corresponding change in time Δt cant have values less than one in Planck units. I can write it as:

$$\left|\frac{\Delta x}{\Delta t}\right| = \frac{nl_P}{mt_P} \tag{1.1}$$

$$n \leq m \tag{1.2}$$

Where n and m are natural numbers and l_P is Planck length and t_P is Planck time. In whole paper i will use notation $(\mathbf{x})$ that means space and time scalar components so for base coordinates its $(\mathbf{x}) = (x^0, x^1, x^2, x^3)$. Not only one unit of change in position in one unit of time is maximum, another part is energy limit. Energy for given Planck length can't be more than one. It means if i have body of radius r its maximum energy can't be more than two per each radius- it comes from that a sphere of radius r have as same mass to center and from center to another part of sphere- it means energy doubles (so does mass) it means for given radius r there is maximum $2r$ energy in Planck units where radius is in Planck length units. Any natural unit like second or meter can be converted to units used here by equation:

$$U_{nm} = \prod_n \prod_m \frac{U_{B_n} U_{P_m}}{U_{B_m} U_{P_n}} \tag{1.3}$$

Where n subscript means unit put into counter and m means unit put into denominator, B means base SI units and P means Planck's units. For many expressions with other units i need to add sum to it:

$$U_{n_g m_g} = \sum_g \prod_n \prod_m \frac{U_{B_{ng}} U_{P_{mg}}}{U_{B_{mg}} U_{P_{ng}}} \tag{1.4}$$

Where it means i can add units that are normally would be not compatible. And get a unit that is correct from point of view of this model.

2. Symmetries and spin

Base idea is that all elementary particles can be produced out of symmetries states. There are two symmetries i will use in this model, that can have positive value S_{+1}, S_{+2} or negative value S_{-1}, S_{-2}. Positive value means that symmetry is fulfilled , negative that its not. There are four possible combinations of spin values that can be represented as a matrix, where v_{nm} represents state and can be equal to one , zero or negative one:

$$\hat{S}(\mathbf{x}) = \begin{pmatrix} \frac{1}{2}v_{11}S_{+1}(\mathbf{x}) & \frac{1}{2}v_{12}S_{+2}(\mathbf{x}) \\ \frac{1}{2}v_{21}S_{-1}(\mathbf{x}) & \frac{1}{2}v_{22}S_{+2}(\mathbf{x}) \\ \frac{1}{2}v_{31}S_{+1}(\mathbf{x}) & \frac{1}{2}v_{32}S_{-2}(\mathbf{x}) \\ \frac{1}{2}v_{41}S_{-1}(\mathbf{x}) & \frac{1}{2}v_{42}S_{-2}(\mathbf{x}) \end{pmatrix}$$

$$= \begin{pmatrix} \frac{1}{2}v_{11}S_{+1}(\mathbf{x}) & \frac{1}{2}v_{12}S_{+2}(\mathbf{x}) \\ -\frac{1}{2}v_{21}S_{+1}(\mathbf{x}) & \frac{1}{2}v_{22}S_{+2}(\mathbf{x}) \\ \frac{1}{2}v_{31}S_{+1}(\mathbf{x}) & -\frac{1}{2}v_{32}S_{+2}(\mathbf{x}) \\ -\frac{1}{2}v_{41}S_{+1}(\mathbf{x}) & -\frac{1}{2}v_{42}S_{+2}(\mathbf{x}) \end{pmatrix} \tag{2.1}$$

Symmetry number for a given system is equal to sum of this matrix elements $S(\mathbf{x}) = \sum_{n,m} S_{nm}(\mathbf{x})$, if first symmetry is fulfilled it means that system is massless $ds^2 = 0$ second symmetry is fulfilled when energy states change so for given system there is not one energy state E but many E_n and they are not equal $(E_0 \neq E_1 ... \neq E_n)$, when first symmetry is not fulfilled then system has mass $ds^2 \neq 0$ and when second is not fulfilled all energy states are equal $(E_0 = E_1 ... = E_n)$. Spin number for a given system is equal to its absolute value of symmetry $|S(\mathbf{x})|$ and from it i can create symmetry-spin vector S^{ϕ_N} that has n states, for each state it has positive value only with n entry of vector and zero everywhere else. For bosons i can have states of spin number that is equal to $N = 2|S(\mathbf{x})| + 1$ where they go from positive spin $|S(\mathbf{x})|$ then positive spin $|S(\mathbf{x})| - 1$ and so on till they get to zero $(|S(\mathbf{x})| - n = 0)$, then they go from negative $-|S(\mathbf{x})| + n \neq 0$ till $-|S(\mathbf{x})| + 0$ and for fermions they go from $|S(\mathbf{x})|$ to $|S(\mathbf{x})| - 1/2n \neq 0$ and then from $-|S(\mathbf{x})| + 1/2n$ to $-|S(\mathbf{x})| + 0$. So now i can write symmetry-spin vector with all states as for fermions and boson:

$$S_F^{\phi} = \begin{pmatrix} \rho_{|S(\mathbf{x})|} \\ 0 \\ ... \\ 0 \end{pmatrix}_1, \begin{pmatrix} 0 \\ \rho_{|S(\mathbf{x})|-1} \\ ... \\ 0 \end{pmatrix}_2 ... \begin{pmatrix} 0 \\ ... \\ \rho_{-|S(\mathbf{x})|+1} \\ 0 \end{pmatrix}_{N-1}, \begin{pmatrix} 0 \\ ... \\ 0 \\ \rho_{-|S(\mathbf{x})|} \end{pmatrix}_N \tag{2.2}$$

$$S_B^{\phi} = \begin{pmatrix} \rho_{|S(\mathbf{x})|} \\ 0 \\ ... \\ 0 \end{pmatrix}_1, \begin{pmatrix} 0 \\ \rho_{|S(\mathbf{x})|-1} \\ ... \\ 0 \end{pmatrix}_2 ... \begin{pmatrix} 0 \\ ... \\ \rho_0 \\ ... \end{pmatrix}_{N/2+1} \begin{pmatrix} 0 \\ ... \\ \rho_{-|S(\mathbf{x})|+1} \\ 0 \end{pmatrix}_N, \begin{pmatrix} 0 \\ ... \\ 0 \\ \rho_{-|S(\mathbf{x})|} \end{pmatrix}_{N+1} \tag{2.3}$$

Subscript in one means what spin state it represents and ρ is probability of spin state number. Where for bosons $|S(\mathbf{x})| = 0, 1, 2...$ for fermions $|S(\mathbf{x})| = 1/2, 3/2...$,each state has one where column number is equal to N state. So its not one vector but N vectors for spin 1/2 particles its $N = 2$ where they get positive and negative spin states. Generally N is number of all states, for bosons its easy to calculate its just $N = 2|S(\mathbf{x})| + 1 = 2p + 1$ where $|S(\mathbf{x})|$ is symmetry number, for fermions its more complex for each spin state there is one number so if i have N states where $N/2$ are positive states and $N/2 + 1...N$ are negative states this number N is number of all possible negative and positive states. It connects to spin number by $|S(\mathbf{x})| - 1/2n \geq 0$ so i get $N = 2p$ where $n = 1, 3..., 2p - 1$. So from spin number i can get possible spin state number by (subscript F means fermions, B bosons):

$$Y_{F_p} = \begin{cases} 1/2(2p-1) \wedge p > 0 \\ 1/2(2p+1) \wedge p < 0 \end{cases}_{-|S(\mathbf{x})| \leq Y_{F_p} \leq |S(\mathbf{x})|} \tag{2.4}$$

$$Y_{B_p} = p \wedge p \in \mathbb{Z}|_{-|S(\mathbf{x})| \leq Y_{B_p} \leq |S(\mathbf{x})|} \tag{2.5}$$

3. Energy from symmetry exchange

Energy by rotation of tensor field is generated by rate of change in symmetries. For given system symmetry number stays constant but it allows for changing in symmetry state, rule is that only positive symmetry state can exchange to positive, negative state exchange to negative they do not change state of symmetry but have energy, when negative symmetry changes to positive or positive to negative they change state of system and carry energy. First symmetry is scalar field of space and time, so it can be threat as scalar function of space and time, for each given point it has value, if i take symmetry in state $S(x^0+\delta x^0,\mathbf{x^a})$ i want to get state of symmetry so just $S(\mathbf{x})$, that time where symmetry changes by unit of symmetry is exchange time and it generates energy :

$$S(\mathbf{x}) = S(x^0+\delta x^0,\mathbf{x^a}) \tag{3.1}$$

$$E(\mathbf{x}) = \sum_{n,m}\sum_{i,j\neq n,m}\frac{S_{nmij}(x^0+\delta x^0_{nmij},\mathbf{x^a})}{\delta x^0_{nmij}} \tag{3.2}$$

$$J(\mathbf{x}) = \frac{Y_p}{|Y_p|}\sum_{n,m}\sum_{i,j\neq n,m}\frac{S_{nmij}(x^0+\delta x^0_{nmij},\mathbf{x^a})}{\delta x^0_{nmij}} \tag{3.3}$$

Where final angle is equal to $\gamma = Y_p\theta$ where θ is physical rotation angle it means for example for spin one half particles rotation by 2π has effect as rotation by π first represents θ angle and second γ angle:

$$J(\mathbf{x}) = \frac{Y_p\dot{\theta}(\mathbf{x})}{2\pi} =$$

$$\frac{\dot{\gamma}(\mathbf{x})}{2\pi} = \frac{Y_p}{|Y_p|}\sum_{n,m}\sum_{i,j\neq n,m}\frac{S_{nmij}(x^0+\delta x^0_{nmij},\mathbf{x^a})}{\delta x^0_{nmij}} \tag{3.4}$$

Where angle θ is defined as for spin state ϕ:

$$\theta_{k(\phi)F}(\mathbf{x}) = \begin{cases} \theta_{k(\phi)}(\mathbf{x}) = +\theta(\mathbf{x}) \to \phi = 1,...,N/2 \to (Y_{F_m} > 0) \\ \theta_{k(\phi)}(\mathbf{x}) = -\theta(\mathbf{x}) \to \phi = N/2+1,...,N \to (Y_{F_m} < 0) \end{cases} \tag{3.5}$$

For bosons its same but i need to add zero energy state that is equal to:

$$\theta_{k(\phi)B}(\mathbf{x}) = \begin{cases} \theta_{k(\phi)}(\mathbf{x}) = +\theta(\mathbf{x}) \to \phi = 1,...,N/2 \to (Y_{B_m} > 0) \\ \theta_{k(\phi)}(\mathbf{x}) = 0 \to \phi = N/2+1 \to (Y_{B_m} = 0) \\ \theta_{k(\phi)}(\mathbf{x}) = -\theta(\mathbf{x}) \to \phi = N/2+2,...,N+1 \to (Y_{B_m} < 0) \end{cases} \tag{3.6}$$

If symmetry energy state is positive S_+ i will get same sign as angle , if its negative S_- i will get opposite sign as angle, it means negative symmetry energy states have opposite spin states, for positive spin state they have negative symmetry energy state and for negative symmetry energy state they have positive spin state. Positive angle represents positive spin $Y_p > 0$ state and negative angle represents negative spin $Y_p < 0$ state. So i can write full angle as:

$$\dot{\gamma} = Y_p\dot{\theta}(\mathbf{x}) = \\ = \frac{Y_p\theta(x^0+\delta x^0, \mathbf{x^a}) - Y_p\theta(\mathbf{x})}{dt} = \frac{\gamma(x^0+\delta x^0, \mathbf{x^a}) - \gamma(\mathbf{x})}{dt} \tag{3.7}$$

Where time that state is changed is equal to T_+ and time when state is not change is equal to T_-:

$$T_- = x^0\left(1 - \sum_{n,m}\sum_{i,j\neq n,m}\frac{1}{\delta x^0_{nmij}}\right) \wedge x^0 \geq \sum_{n,m}\sum_{i,j\neq n,m}\delta x^0_{nmij} \tag{3.8}$$

$$T_+ = x^0\left(\sum_{n,m}\sum_{i,j\neq n,m}\frac{1}{\delta x^0_{nmij}}\right) \wedge x^0 \geq \sum_{n,m}\sum_{i,j\neq n,m}\delta x^0_{nmij} \tag{3.9}$$

Where angular speed is defined :

$$\omega r = \frac{|Y_p|\dot{\theta}(\mathbf{x})}{2\pi} \tag{3.10}$$

I can write E and J for many bodies as:

$$E_{kl}(\mathbf{x}) = \sum_{k,l}\sum_{n,m}\sum_{i,j\neq n,m} V(k,l)\frac{S_{nmijkl}(x^0+\delta x^0_{nmijkl}R_{kl}, \mathbf{x^a})}{\delta x^0_{nmijkl}R_{kl}} \tag{3.11}$$

$$J_{kl}(\mathbf{x}) = \sum_{k,l}\sum_{n,m}\sum_{i,j\neq n,m} f(k,l)V(k,l)\frac{S_{nmijkl}(x^0+\delta x^0_{nmijkl}R_{kl}, \mathbf{x^a})}{\delta x^0_{nmijkl}R_{kl}} \tag{3.12}$$

Where angular speed is for many systems :

$$\omega_{kl}r_{kl} = \frac{|Y_p|_{kl}\dot{\theta}_{kl}(\mathbf{x})}{2\pi} = J_{kl}(\mathbf{x}) \\ = \sum_{k,l}\sum_{n,m}\sum_{i,j\neq n,m} f(k,l)V(k,l)\frac{S_{nmijkl}(x^0+\delta x^0_{nmijkl}R_{kl}, \mathbf{x^a})}{\delta x^0_{nmijkl}R_{kl}} \tag{3.13}$$

Now only thing left is to calculate interaction time and time where there is no interaction, it depends on how all objects exchange energy, most simple way is just sum of all individual interaction times, more complex picture is sum of all interaction for given system k with interaction l:

$$T_{-k} = x^0 \left(1 - \sum_l \sum_{n,m} \sum_{i,j \neq n,} \frac{1}{\delta x^0_{nmijkl}}\right)$$
$$\wedge x^0 \geq \sum_l \sum_{n,m} \sum_{i,j \neq n,m} \delta x^0_{nmij} \tag{3.14}$$

$$T_{+k} = x^0 \left(\sum_l \sum_{n,m} \sum_{i,j \neq n,m} \frac{1}{\delta x^0_{nmijkl}}\right)$$
$$\wedge x^0 \geq \sum_l \sum_{n,m} \sum_{i,j \neq n,m} \delta x^0_{nmijkl} \tag{3.15}$$

Where function $f(k,l)$ and $V(n,m)$ is equal to:

$$f(k,l) := \begin{cases} +1 \Rightarrow k = l \\ -1 \Rightarrow k \neq l \wedge Y_{l_p} < 0 \wedge Y_{k_p} > 0 \vee Y_{l_p} > 0 \wedge Y_{k_p} < 0 \\ +1 \Rightarrow k \neq l \wedge Y_{l_p} < 0 \wedge Y_{k_p} < 0 \vee Y_{l_p} > 0 \wedge Y_{k_p} > 0 \\ 0 \Rightarrow Y_{l_p} = 0 \end{cases} \tag{3.16}$$

$$V(k,l) := \begin{cases} +1 \rightarrow S_{nmijkl} = S_{nmijlk} \\ -1 \rightarrow S_{nmijkl} \neq S_{nmijlk} \\ 0 \rightarrow S_{nmijkl} = S_{nmijlk} = 0 \vee S_{nmijlk} = 0 \vee S_{nmijkl} = 0 \end{cases} \tag{3.17}$$

4. Particles of Standard Model

From symmetry model i can map all particles of Standard Model to symmetry states. I will use a table with matter (symmetrical state) and anti-matter (anti-symmetrical), where i use matrix S_{nm} elements with v_{nm} states as a sign :

Elementary Particles		
Particle	Matter State (symmetrical)	Anti-Matter State (anti-symmetrical)
Photon	$+S_{11},+S_{12}$	$-S_{11},-S_{12}$
Electron/Muon/Tau	$-S_{11},+S_{21},+S_{22}$	$+S_{11},-S_{21},-S_{22}$
Quarks (up, charm, top)	$-S_{11},-S_{12},-S_{21},+S_{31},-S_{32}$	$+S_{11},+S_{12},+S_{21},-S_{31},+S_{32}$
Quarks (down, strange, bottom)	$+S_{11},+S_{12},+S_{21},-S_{31},+S_{32}$	$-S_{11},-S_{12},-S_{21},+S_{31},-S_{32}$
Graviton	$+S_{11},+S_{12},-S_{41},-S_{42}$	$-S_{11},-S_{12},+S_{41},+S_{42}$
Higgs Boson	$+S_{11},-S_{12}$	$-S_{11},+S_{12}$
$W^{\pm}$ Boson	$-S_{11},+S_{12},-S_{21},+S_{22}$	$+S_{11},-S_{12},+S_{21},-S_{22}$
Z Boson	$+S_{41},+S_{42}$	$+S_{41},+S_{42}$
Neutrino	$+S_{12},+S_{41},-S_{42}$	$-S_{12},-S_{41},+S_{42}$
Gluon	$+S_{11},+S_{12},-S_{41},+S_{42}$	$-S_{11},-S_{12},+S_{41},-S_{42}$

From it there is electric charge calculation:

$$Q(\mathbf{x}) = \frac{S(\mathbf{x})}{|S(\mathbf{x})|}\left(\sum_{n=2,3}\sum_{i=2,3,j\neq n=1,2}\left|\frac{S_{n1ij}(x^0+\delta x^0_{n1ij},\mathbf{x^a})}{\delta x^0_{n1ij}}\right|\right) + \frac{S(\mathbf{x})}{|S(\mathbf{x})|}\left(\sum_{n=2,3}\sum_{i=2,3,j\neq n=1,2}\left|\frac{S_{n2ij}(x^0+\delta x^0_{n2ij},\mathbf{x^a})}{\delta x^0_{n2ij}}\right|\right) \tag{4.1}$$

Total charge for quarks is one third or two third it mean that exchange of symmetry state that generate charge does not happen in Planck time but slower to give one third or two third $(1/6+1/6+1/3) = 2/3; (1/6+1/12+1/12) = 1/3)$. Idea is that each particle can exchange symmetry with another particle positive ones to positive ones and negative ones for negative ones, exchange of negative symmetry and positive symmetry states carries energy and does change state of particle. Electric field created by charges energy is equal to (where α is fine structure constant):

$$\Phi_k(\mathbf{x}) = \sum_l q(k,l)\frac{\alpha}{R_{kl}}Q_{kl}(\mathbf{x}) \tag{4.2}$$

$$q(k,l) = \begin{cases} + \to \frac{Q_k}{|Q_k|} = \frac{Q_l}{|Q_l|} \\ - \to \frac{Q_k}{|Q_k|} \neq \frac{Q_l}{|Q_l|} \end{cases} \quad Q_{kl}(\mathbf{x}) = \begin{cases} Q_k \to k = l \\ Q_l \to k \neq l \end{cases} \tag{4.3}$$

From it comes idea of four new particles. All of them are force caring bosons but three of them have mass, one is massless graviton. Those first three particles interact only by gravity, and could be so called dark matter particles, they are created every-time there is creation of any force caring boson but they have mass. So that is anti-photon, anti-graviton and anti-gluon and graviton.

5. Symmetry field

In this paper i presented simple and possible idea how to quantize gravity and put all particles and forces of Standard Model as one model that comes out of spin states. Last part is to put symmetry field into play, to do it first i start with energy levels. There is base energy level for each symmetry interaction that can't be lower than it E_0, next energy level is increased by change in interaction time that change can be zero or can be done in any steps but with limit of maximum Planck Energy, each step is multiplication of Planck time and can be any natural number (of Planck Times) if system obeys second symmetry if not there is always same state of energy so it means system can exchange only one energy level. Now i need to add probability and i can write Symmetry field as, where c is some complex number depending on a problem:

$$K(\mathbf{x}) = \sum_{\eta=1}^{N}\sum_{k,l}\sum_{n,m}\sum_{i,j\neq n,m}\frac{1}{N_{A_{nmijklE}}}\left(\frac{c_{nmijkl\eta}}{1+|E_{nmijkl\eta}-E_0|}\right) \times\frac{S_{nmijkl\eta}(x^0+\delta x^0_{nmijklp\eta}R_{kl\eta},\mathbf{x^a})}{\delta x^0_{nmijkl\eta}R_{kl\eta}} \tag{5.1}$$

Probability of field being in energy state E_η is equal to:

$$A_{nmijklE}A^*_{nmijklE} = \left(\frac{1}{N_{A_{nmijklE}}}\left(\frac{c_{nmijkl\eta}}{1+|E_{nmijkl\eta}-E_0|}\right)\right) \times\left(\frac{1}{N^*_{A_{nmijklE}}}\left(\frac{c_{nmijkl\eta^*}}{1+|E_{nmijkl\eta}-E_0|}\right)\right) \tag{5.2}$$

$$\sum_{E=E_0}^{E_P} A_{nmijklE}A^*_{nmijklE} = \sum_{\eta=1}^{N}\left(\frac{1}{N_{A_{nmijklE}}}\left(\frac{c_{nmijkl\eta}}{1+|E_{nmijkl\eta}-E_0|}\right)\right) \times\left(\frac{1}{N^*_{A_{nmijklE}}}\left(\frac{c^*_{nmijkl\eta}}{1+|E_{nmijkl\eta}-E_0|}\right)\right) = 1 \tag{5.3}$$

For given symmetry field- symmetry must be always conserved, it means that sum of all symmetry number after and before interaction has to be equal:

$$\sum_{k,l}\sum_{n,m}\sum_{i,j\neq n,m} S_{nmijkl}(x^0+\delta x^0_{nmijkl}R_{kl},\mathbf{x^a}) = \\ = \sum_{k,l}\sum_{n,m}\sum_{i,j\neq n,m} S_{nmijkl}(x^0,\mathbf{x^a}) \tag{5.4}$$

And so for all space they have to be equal before and after interaction:

$$\int \sum_{k,l}\sum_{n,m}\sum_{i,j\neq n,m} S_{nmijkl}(x^0+\delta x^0_{nmijkl}R_{kl},\mathbf{x^a})dx^3 = \\ = \int \sum_{k,l}\sum_{n,m}\sum_{i,j\neq n,m} S_{nmijkl}(x^0,\mathbf{x^a})dx^3 \tag{5.5}$$

From speed i can calculate energy - or from change in energy from base energy i can calculate sum of all speed vector components for massive and massless particles where E_0 is lowest energy interaction with Higgs field :

$$\left(\sum_{\mu}\dot{x}^{\mu}\dot{x}^{\mu}\right)^{1/2} = 1+\sqrt{1-\frac{E_0^2}{\left(\sum_{k,l}\sum_{n,m}\sum_{i,j\neq n,m}\frac{1}{\delta x^0_{nmijkl}}\right)^2}} \\ +\left(\sum_{k,l}\sum_{n,m}\sum_{i,j\neq n,m}\frac{1}{\delta x^0_{nmijkl}}\right)\left(1-\sqrt{1-\frac{E_0^2}{\left(\frac{1}{\sum_{k,l}\sum_{n,m}\sum_{i,j\neq n,m}\delta x^0_{nmijkl}}\right)^2}}\right) \tag{5.6}$$

Now i can calculate interaction between any matter particle and Higgs field and its zero mass is defined as zero energy interaction but mass that has part in gravity is not zero mass but does increase with strength of interaction with Higgs field so its equal to (where plus means matter Higgs field state and minus anti-matter Higgs field state):

$$E_{H_\pm,M}(\mathbf{x}) = \sum_{H_\pm,M}\sum_{n,m}\sum_{i,j\neq n,m} V(H_\pm,M)\frac{S_{nmijH_\pm M}(x^0+\delta x^0_{nmijH_\pm M},\mathbf{x^a})}{\delta x^0_{nmijH_\pm M}} \tag{5.7}$$

$$E_{H_+,M}(\mathbf{x}) = \sum_{n,m}\sum_{i,j\neq n,m} V(H_+,M)\frac{S_{nmijH_+M}(x^0+\delta x^0_{nmijH_+M},\mathbf{x^a})}{\delta x^0_{nmijH_+M}} \\ +V(M,H_+)\frac{S_{nmijMH_+}(x^0+\delta x^0_{nmijMH_+},\mathbf{x^a})}{\delta x^0_{nmijMH_+}} \tag{5.8}$$

$$E_{H_-,M}(\mathbf{x}) = \sum_{n,m}\sum_{i,j\neq n,m} V(H_-,M)\frac{S_{nmijH_-M}(x^0+\delta x^0_{nmijH_-M},\mathbf{x^a})}{\delta x^0_{nmijH_-M}}$$
$$+V(M,H_-)\frac{S_{nmijMH_-}(x^0+\delta x^0_{nmijMH_-},\mathbf{x^a})}{\delta x^0_{nmijMH_-}} \tag{5.9}$$

So zero state is zero energy:

$$E_0 = E_{H_{\pm 0},M_0}(\mathbf{x})$$
$$= \sum_{H_{\pm 0},M_0}\sum_{n,m}\sum_{i,j\neq n,m} V(H_{\pm 0},M_0)\frac{S_{nmijH_{\pm 0}M_0}(x^0+\delta x^0_{nmijH_{\pm 0}M_0},\mathbf{x^a})}{\delta x^0_{nmijH_{\pm 0}M_0}} \tag{5.10}$$

6. Metric tensor and geometry

In real space-time each photon traces path that time component of distance is equal to space ones i can write that equality as [2]:

$$\eta_{\mu\nu}\frac{\partial\xi^{\mu}}{\partial x^{0}}\frac{\partial\xi^{\nu}}{\partial x^{0}}dx^{0}dx^{0}=-\eta_{\mu\nu}\frac{\partial\xi^{\mu}}{\partial x^{a}}\frac{\partial\xi^{\nu}}{\partial x^{a}}dx^{a}dx^{a} \tag{6.1}$$

I can write equality between normal and imaginary space-time as, that holds for all objects not depending on their speed:

$$\eta_{\mu\nu}\frac{\partial\xi^{\mu}}{\partial x^{\alpha}}\frac{\partial\xi^{\nu}}{\partial x^{\beta}}dx^{\alpha}dx^{\beta}=\eta_{\mu\nu}\frac{\partial\xi^{\mu}}{\partial x^{\alpha}}\frac{\partial\xi^{\nu}}{\partial x^{\beta}}idx^{\alpha}idx^{\beta} \tag{6.2}$$

$$\eta_{\mu\nu}\frac{\partial\xi^{\mu}}{\partial x^{\alpha}}\frac{\partial\xi^{\nu}}{\partial x^{\beta}}dx^{\alpha}dx^{\beta}=-\eta_{\mu\nu}\frac{\partial\xi^{\mu}}{\partial x^{\alpha}}\frac{\partial\xi^{\nu}}{\partial x^{\beta}}dx^{\alpha}dx^{\beta} \tag{6.3}$$

It means that for normal particle that is not moving with speed of light this zero space-time interval hold true in complex space-time, i can prove it plotting complex space-time identity:

$$\begin{aligned}&\eta_{\mu\nu}\frac{\partial\xi^{\mu}}{\partial x^{0}}\frac{\partial\xi^{\nu}}{\partial x^{0}}dx^{0}dx^{0}+\eta_{\mu\nu}\frac{\partial\xi^{\mu}}{\partial x^{a}}\frac{\partial\xi^{\nu}}{\partial x^{a}}dx^{a}dx^{a}\\ &=-\eta_{\mu\nu}\frac{\partial\xi^{\mu}}{\partial x^{0}}\frac{\partial\xi^{\nu}}{\partial x^{0}}dx^{0}dx^{0}-\eta_{\mu\nu}\frac{\partial\xi^{\mu}}{\partial x^{a}}\frac{\partial\xi^{\nu}}{\partial x^{a}}dx^{a}dx^{a}\end{aligned} \tag{6.4}$$

$$\eta_{\mu\nu}\frac{\partial\xi^{\mu}}{\partial x^{0}}\frac{\partial\xi^{\nu}}{\partial x^{0}}dx^{0}dx^{0}=-\eta_{\mu\nu}\frac{\partial\xi^{\mu}}{\partial x^{a}}\frac{\partial\xi^{\nu}}{\partial x^{a}}dx^{a}dx^{a} \tag{6.5}$$

There is relation between tensor wave field and metric of space-time, i can write this relation as, where there is rotation operator components derivative is put as double dot- its only derivative of its components not tensor itself and operator acting on wave field that is equal to:

$$g_{\mu\nu}\psi^{\mu\nu}_{\pm}(\mathbf{x})=\eta_{\mu\nu}\psi^{\mu\nu}_{\pm}(\mathbf{x})\pm i\eta_{\mu\nu}\mathbf{D}_{\mu}\psi^{\mu\nu}_{\pm}(\mathbf{x}) \tag{6.6}$$

$$\mathbf{D}_{\mu}\psi^{\mu\nu}=\partial_{\mu}\psi^{\mu\nu}\hat{e}_{\mu}\otimes\hat{e}_{\nu}-\psi^{\mu\nu}\partial_{\mu}\hat{e}_{\mu}\otimes\hat{e}_{\nu}-\psi^{\mu\nu}\hat{e}_{\mu}\otimes\partial_{\mu}\hat{e}_{\nu} \tag{6.7}$$

Solutions to this equation are solutions both to wave function and metric tensor. Indexes in δ mean rotation operator directions, they can be for spin only time and one space component. Where rotation tensor is equal to[3]:

$$R^{\alpha\beta}_{\mu\nu}=R^{\alpha}_{\mu}(\gamma)_{0q}R^{\alpha}_{\nu}(\gamma)_{0q} \tag{6.8}$$

Where γ is angle from chapter three and subscript after γ means rotation axis that is always $0q$ where $q=1,2,3$ that means it is only space one direction and time.

7. Probability

First i can calculate spin probability [4], if i have rotation by angle γ by any space axis and time axis there is probability of spin state that is equal to:

$$\sum_{\phi} S^{\phi} S^{\phi *} = 1 \tag{7.1}$$

That holds true for one system, but it does hold true for many systems, i need to add indexes kl and turn it into tensor so i get:

$$\forall_{k,l} \sum_{\phi_k,\phi_l} S^{\phi_k \phi_l} S^{\phi_k \phi_l *} = 1 \tag{7.2}$$

Where k, l represents spin of system k interacting with spin of system l. Where self interaction term has only components that are not equal to zero when $\phi_k = \phi_l$, by self interaction term i mean $k = l$ case- its needed for one particle to be in only one state when measured so that's why self interaction that allow two states of one particle at once has to be equal to zero. Last probability is wave function probability, i can write it as sum of space components of wave function being equal to one- integrated:

$$\int \sum_{a,b} \psi^{ab} \psi^{ab*} dx^a dx^b = 1 \tag{7.3}$$

Wave function does not have off diagonal space components so it reduces to:

$$\int \sum_{a} \psi^{aa} \psi^{aa*} dx^a dx^a = 1 \tag{7.4}$$

For any given area i get probability of finding particle there as:

$$\int_{x_0}^{x_1} \sum_{a} \psi^{aa} \psi^{aa*} dx^a dx^a = P(x_0, x_1) \tag{7.5}$$

8. Many system equation and postulates

I can write many system equation and rotation tensor as:

$$g_{\mu_k\nu_l}\psi_{\pm}^{\mu_k\nu_l}(\mathbf{x}) = \eta_{\mu_k\nu_l}\psi_{\pm}^{\mu_k\nu_l}(\mathbf{x}) \pm i\eta_{\mu_k\nu_l}\mathbf{D}_{\mu_k}\psi_{\pm}^{\mu_k\nu_l}(\mathbf{x}) \tag{8.1}$$

$$R_{\mu_k\nu_l}^{\alpha_k\beta_l} = R_{\mu_k}^{\alpha_k}(\gamma_{kl})_{0_{kl}q_{kl}} R_{\nu_l}^{\beta_l}(\gamma_{kl})_{0_{kl}q_{kl}} \tag{8.2}$$

Angle γ_{kl} corresponds to to energy E_{kl} and spin energy J_{kl} of kl symmetry field term, and from it follows electric charge Φ_k for that interaction. Spin term $S^{\phi_k\phi_l}$ represents angle γ_{kl}. Probability for position holds same but with additional indexes:

$$\int \sum_{a_k,a_l} \Psi^{a_k a_l}\Psi^{a_k a_l *} dx^{a_k} dx^{a_l} = 1 \tag{8.3}$$

$$\int_{x_0}^{x_1} \sum_{a_k,a_l} \Psi^{a_k a_l}\Psi^{a_k a_l *} dx^{a_k} dx^{a_l} = P_{kl}(x_0, x_1) \quad (4) \tag{8.4}$$

Flat space-time metric $\eta_{\mu\nu}$ is equal to one for time-time component and one space-time, time-space component then minus one for diagonal space components for all other components its zero:

$$\eta_{\mu\nu} = \eta_{00} = -\eta_{11} = -\eta_{22} = -\eta_{33} = \eta_{0q} = \eta_{q0} = 1 \tag{8.5}$$

$$\eta_{\mu\nu} \neq \eta_{00} \neq -\eta_{11} \neq -\eta_{22} \neq -\eta_{33} \neq \eta_{0q} \neq \eta_{q0} = 0 \tag{8.6}$$

Where time-space, space-time component comes from rotation axis q. Energy that comes from symmetry interaction is connected with wave field by:

$$\eta_{\mu\mu}\mathbf{D}_\mu\psi_{\pm}^{\mu\mu}(\mathbf{x}) = \pm iE(\mathbf{x})(1 - \sum_a \dot{x}^a\dot{x}^a)\psi_{\pm}^{\mu\mu}(\mathbf{x}) \tag{8.7}$$

$$\begin{aligned}\eta_{\mu\nu}\mathbf{D}_\mu\psi_{\pm}^{\mu\nu}(\mathbf{x}) &= \eta_{0q}\mathbf{D}_0\psi_{\pm}^{0q}(\mathbf{x}) + \eta_{q0}\mathbf{D}_q\psi_{\pm}^{q0}(\mathbf{x}) \\ &= \pm iJ^2(\mathbf{x})E(\mathbf{x})\cos^2(\varphi)\left(\psi_{\pm}^{0q}(\mathbf{x}) + \psi_{\pm}^{q0}(\mathbf{x})\right)\end{aligned} \tag{8.8}$$

Now i can calculate energy from wave field components and energy of symmetry field as:

$$\sum_\mu \mathbf{D}_\mu\psi_{\pm}^{\mu\mu}(\mathbf{x}) = \sum_\mu \pm iE(\mathbf{x})\dot{x}^\mu\dot{x}^\mu\psi_{\pm}^{\mu\mu}(\mathbf{x}) \tag{8.9}$$

$$\sum_{\mu\neq\nu} \mathbf{D}_\mu\psi_{\pm}^{\mu\nu}(\mathbf{x}) = \pm iJ^2(\mathbf{x})E(\mathbf{x})\cos^2(\varphi)\left(\psi_{\pm}^{0q}(\mathbf{x}) + \psi_{\pm}^{q0}(\mathbf{x})\right) \tag{8.10}$$

First there is need to calculate probability of symmetry state field (1) , then from it i can solve field equation with certain spin, energy states (2) and then use rotation operator on field (3) and finally calculate spin and position probability (4) :

$$A_{nmijklE}A^{*}_{nmijklE} \quad (1)$$

$$E_{kl}(\mathbf{x}) = \sum_{k,l}\sum_{n,m}\sum_{i,j\neq n,m} V(k,l)\frac{S_{nmijkl}(x^0+\delta x^0_{nmijkl}R_{kl},\mathbf{x^a})}{\delta x^0_{nmijkl}R_{kl}} \tag{8.11}$$

$$J_{kl}(\mathbf{x}) = \sum_{k,l}\sum_{n,m}\sum_{i,j\neq n,m} f(k,l)V(k,l)\frac{S_{nmijkl}(x^0+\delta x^0_{nmijkl}R_{kl},\mathbf{x^a})}{\delta x^0_{nmijkl}R_{kl}}$$

$$g_{\mu_k\nu_l}\psi^{\mu_k\nu_l}_{\pm}(\mathbf{x}) = \eta_{\mu_k\nu_l}\psi^{\mu_k\nu_l}_{\pm}(\mathbf{x}) \pm i\eta_{\mu_k\nu_l}\mathbf{D}_{\mu_k}\psi^{\mu_k\nu_l}_{\pm}(\mathbf{x}) \quad (2) \tag{8.12}$$

$$R^{\alpha_k}_{\mu_k}(\gamma_{kl})_{0_{kl}q_{kl}}R^{\beta_l}_{\nu_l}(\gamma_{kl})_{0_{kl}q_{kl}}\psi^{\mu_k\nu_l}(\mathbf{x}) = \Psi^{\alpha_k\beta_l}(\mathbf{x}) \quad (3) \tag{8.13}$$

$$\forall_{k,l}\sum_{\phi_k,\phi_l} S^{\phi_k\phi_l}S^{\phi_k\phi_l *} = 1$$

$$\int_{x_0}^{x_1}\sum_{a_k,a_l}\Psi^{a_ka_l}\Psi^{a_ka_l *}dx^{a_k}dx^{a_l} = P_{kl}(x_0,x_1) \quad (4) \tag{8.14}$$

9. Solutions

Field equation is very easy to solve if i know energy of system so its symmetry states. Simplest gravity solutions is just $E(\mathbf{x}) = \frac{2M}{R}$ that i will explore in this section, where M is mass and R is radius from body. Next part is to calculate spin energy, i will use very use formula $J(\mathbf{x}) = \omega r$ where ω is angular speed and r is body radius. So now i can plug those solutions to equations first i start with wave field-energy relation:

$$\mathbf{D}_\mu \psi^{\mu\mu}_{\pm}(\mathbf{x}) = \pm i \frac{2M}{R} \dot{x}^\mu \dot{x}^\mu \psi^{\mu\mu}_{\pm}(\mathbf{x}) \tag{9.1}$$

$$\mathbf{D}_\mu \psi^{\mu\nu}_{\pm}(\mathbf{x}) = \pm i \omega^2 r^2 \frac{2M}{R} \cos^2(\varphi) \left(\psi^{0q}_{\pm}(\mathbf{x}) + \psi^{q0}_{\pm}(\mathbf{x}) \right) \tag{9.2}$$

So solutions are just exponential functions with imaginary unit:

$$\psi^{\mu\mu}_{\pm}(\mathbf{x}) = c^\mu(x) \exp\left(\pm i \frac{2M}{R} \dot{x}^\mu \dot{x}^\mu x^\mu \right) \hat{e}_\mu \otimes \hat{e}_\mu \tag{9.3}$$

$$\psi^{\mu\nu}_{\pm}(\mathbf{x}) = c^\mu(x) \exp\left(\pm i \omega^2 r^2 \frac{2M}{R} \cos^2(\varphi) x^\mu \right) \hat{e}_\mu \otimes \hat{e}_\nu \Big|_{\mu \neq \nu} \tag{9.4}$$

From it, its a straight step to calculate metric as:

$$g_{\mu\mu} = \left(1 - \frac{2M}{R} \dot{x}^\mu \dot{x}^\mu \right) \tag{9.5}$$

$$g_{\mu\nu} = \left(1 - \omega^2 r^2 \frac{2M}{R} \cos^2(\varphi) \right) \Big|_{\mu \neq \nu} \tag{9.6}$$

So i can write space-time interval as, where q is rotation axis that in simplest case is just one of x, y, z coordinate if not i need to change base so there is direction of rotation as one of directions:

$$\begin{aligned} ds^2 = \left(1 - \frac{2M}{R} \right) dt^2 - \left(1 - \frac{2M}{R} \dot{x}^1 \dot{x}^1 \right) dx^2 - \left(1 - \frac{2M}{R} \dot{x}^2 \dot{x}^2 \right) dy^2 \\ - \left(1 - \frac{2M}{R} \dot{x}^3 \dot{x}^3 \right) dz^2 + 2 \left(1 - \omega^2 r^2 \frac{2M}{R} \cos^2(\varphi) \right) dt dq \end{aligned} \tag{9.7}$$

So time component is same as in General Relativity simplest solutions to non rotating black hole, but big change is that space components are not growing to infinity but are getting smaller and smaller. It means there is contraction in both space and time components of metric, stronger gravity more contraction there is. It means falling observer has shorter distance of falling than observer that stands still on surface of object. This effect for photons is that only see space and time get shorter equally. For low energy falling depends only on time dilation (speed squared is very low compared to speed of light).

References

[1] For all used calculation here i used Wolfram Alpha
https://www.wolframalpha.com

[2] Minkowski metric tensor
https://mathworld.wolfram.com/MinkowskiMetric.html

[3] A new perspective on spacetime 4D rotations and the SO(4) transformation group
https://www.sciencedirect.com/science/article/pii/S221137971832076X

[4] THEORETICAL CONCEPTS OF QUANTUM MECHANICS
http://www.issp.ac.ru/ebooks/books/open/Theoretical_Concepts_of_Quantum_Mechanics.pdf