Modified spherical space-time gravity model

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Abstract

Quantum gravity is one of most open problem in modern physics, in this paper i will show approach to this problem that is spherical space-time. That spherical space-time uses modified 4-sphere metric and from it it constructs gravity effects. Key idea is to use Planck scale of energy. Field equation connects metric with energy and wave function tensor. Model gives close to General Relativity solutions for low energies and does not break at singularity of a black hole. It states that time and space are effects of 4-sphere rotations with radius understood as light signal that travels with speed of light- for gravity system that travel is slow down by gravity itself. At singularity it leads to loops of space-time, energy is understood as change in angle for given coordinate of 4-sphere. Energy tensor and field equation are written in covariant form and laws of physics come from covariant form- field equation can be written in contravariant form but it has no physical meaning.

Contents

Section 1: Geometry of modified spherical space-time

1.1 4-sphere metric

In this model i will use metric that comes from modified 4-sphere metric. First change is that fourth coordinate has plus sign and rest have minus sign to make it space-time , so fourth coordinate is understood as time coordinate. Another change is that each coordinate is multiply by a factor that makes equal to zero for Planck energy, i can write that part as $\left(1-\sqrt{T_\mu \cdot T_\mu}\right)$ where T_μ is component of energy tensor i will introduce later. Plus sign for time coordinate (four 4-sphere coordinate) means i use metric signature $(+---)$ it will be used in whole idea. Radius of 4-sphere is equal to time multiply by speed of light $r = ct$ that is needed for space-time to work. It means light signal is equal to radius of 4-sphere. Each event is understood as point on 4-sphere that grows with time that passes. Metric tensor can be created out of tensor product of two tensors g_μ and g_ν they are not equal, key change is sign in first is positive for first component and negative for rest- second one has all components sign positive. It means μ component is responsible for sign. So i can write metric tensor as product of those two vectors:

$$g_{\mu\nu} = g_\mu \otimes g_\nu = \begin{pmatrix} r\left(1-\sqrt{T_0 \cdot T_0}\right) \\ -r\left(1-\sqrt{T_1 \cdot T_1}\right)\sin(\phi_4) \\ -r\left(1-\sqrt{T_2 \cdot T_2}\right)\sin(\phi_4)\sin(\phi_3) \\ -r\left(1-\sqrt{T_3 \cdot T_3}\right)\sin(\phi_4)\sin(\phi_3)\sin(\phi_2) \end{pmatrix} \otimes \begin{pmatrix} r\left(1-\sqrt{T_0 \cdot T_0}\right) \\ r\left(1-\sqrt{T_1 \cdot T_1}\right)\sin(\phi_4) \\ r\left(1-\sqrt{T_2 \cdot T_2}\right)\sin(\phi_4)\sin(\phi_3) \\ r\left(1-\sqrt{T_3 \cdot T_3}\right)\sin(\phi_4)\sin(\phi_3)\sin(\phi_2) \end{pmatrix} \tag{1.1.1}$$

Spherical coordinates are denoted as $\phi_4 = x_0, \phi_3 = x_1, \phi_2 = x_2, \phi_1 = x_3$ that means fourth spherical coordinate is equal to zero coordinate, third spherical is equal to first and so on. Space-time interval is equal to that metric tensor times base spherical vectors i can write it as (where Einstein summation convection is used):

$$ds^2 = g_{\mu\nu} dx^\mu dx^\nu = g_\mu \otimes g_\nu dx^\mu dx^\nu \tag{1.1.2}$$

1.2 Relative length transform

From rotation in fourth direction (4-sphere fourth direction is time) comes fact that light signal sent by rotation with an angle does not come to all observers at same time. It leads to relative transform of length and time that passes for one observer from point of reference of another observer. Fourth axis can be rotated by maximum π angle so transformation uses first component of energy tensor T_0, multiply by π to get angle of axis. I have two observers , first time axis (ϕ_4) and second observer who axis is (ϕ_4') . For time relative change i will get $\cos(\phi_4' - \phi_4)$ factor of change in time flow. it comes from a fact that second observer who axis is more rotated it takes longer to reach a light signal from it, longer it takes less time passes from point of view of first observer. Second transformation says how much distance in space changes, it's opposite of time transformation- it means that if first observer moves in space second rotated more observer can move more distance in space- for any given point of time. I can write those two transformation as (where k denotes $1,2,3$):

$$d\phi_4' = \cos((\pi\sqrt{T_0' \cdot T_0'}) - \pi\sqrt{T_0 \cdot T_0})d\phi_4 \tag{1.2.1}$$

$$d\phi_k' = \sec((\pi\sqrt{T_0' \cdot T_0'}) - \pi\sqrt{T_0 \cdot T_0})d\phi_k \tag{1.2.2}$$

1.3 Wave field tensor

In order to describe a quantum system i need a wave like object. I will use tensor that is denoted with covariant components as:

$$\partial_\mu \partial_\nu \left(\Psi_\mu \cdot \Psi_\nu\right) + \frac{1}{2}\left(T_\mu \cdot T_\mu + T_\nu \cdot T_\nu\right)\left(\Psi_\mu \cdot \Psi_\nu\right) = \Psi_{\mu\nu} \tag{1.3.1}$$

Where $\partial_\mu = \frac{\partial}{\partial \phi_\mu}$ where ϕ_μ is 4-sphere μ coordinate. And energy tensor components are multiply, it's scalar multiply. For any given system this tensor has to be equal to zero so wave field tensor vanish:

$$\Psi_{\mu\nu} = 0 \tag{1.3.2}$$

It leads to wave field tensor that is some kind of cyclic functions (i will present simplest solution in last section). This tensor is key idea behind this model, this tensor vanishing means that for given system there is no difference between energy of field and change in it's coordinate- saying more precise change in coordinate is equal to minus energy of that coordinate. It means any change in coordinate generates energy change in field, minus sign means all change in motion generates opposite change in energy. It mean that any change in coordinate generates form of kinetic energy, so to change position of object there is need to change it's energy. Because there is a tensor that depends on two coordinates each of them acts as kinetic energy change. It lead to simple physical statement , for any given system there can't be change in it's motion without change in it's kinetic energy so gravity acting is just change in kinetic energy thus it leads to motion. So there is no difference between motion and gravity. More precise acceleration (second derivative) of any coordinate is equal to it's kinetic energy.

Section 2: Field equation

2.1 Energy tensor

Wave energy field tensor states that there is no difference between kinetic energy and motion thus gravity- it depends on object that has energy components and each of that energy component is equal to change of motion. If system changes it's motion it accelerates equally to kinetic energy of that change in motion. That kinetic energy for wave like system is equal to it's frequency. Frequency is equal to derivative with respect to given angle (for spherical coordinates there are four of them) of scalar function that is angle with respect four spherical coordinates. Energy tensor is written in covariant form so it's needed to transform this way. I can write energy tensor as tensor product of two vectors that is same like with metric tensor only change are components of that vectors. For given scalar function of angle with respect to spherical coordinates it's equal to derivative of that function with respect to coordinate times Planck constant- it needs to be normalized to one for Planck unit of energy so it's divided by Planck energy, i can write it as:

$$T_{\mu\nu} = T_\mu \otimes T_\nu = \begin{pmatrix} \frac{\hbar}{E_P}\frac{\partial\varphi(\phi_1,\phi_2,\phi_3,\phi_4)}{\partial\phi_4} \\ -\frac{\hbar}{E_P}\frac{\partial\varphi(\phi_1,\phi_2,\phi_3,\phi_4)}{\partial\phi_3} \\ -\frac{\hbar}{E_P}\frac{\partial\varphi(\phi_1,\phi_2,\phi_3,\phi_4)}{\partial\phi_2} \\ -\frac{\hbar}{E_P}\frac{\partial\varphi(\phi_1,\phi_2,\phi_3,\phi_4)}{\partial\phi_1} \end{pmatrix} \otimes \begin{pmatrix} \frac{\hbar}{E_P}\frac{\partial\varphi(\phi_1,\phi_2,\phi_3,\phi_4)}{\partial\phi_4} \\ \frac{\hbar}{E_P}\frac{\partial\varphi(\phi_1,\phi_2,\phi_3,\phi_4)}{\partial\phi_3} \\ \frac{\hbar}{E_P}\frac{\partial\varphi(\phi_1,\phi_2,\phi_3,\phi_4)}{\partial\phi_2} \\ \frac{\hbar}{E_P}\frac{\partial\varphi(\phi_1,\phi_2,\phi_3,\phi_4)}{\partial\phi_1} \end{pmatrix} \tag{2.1.1}$$

$$T_{\mu\nu} = \begin{pmatrix} \frac{\hbar^2}{E_P^2}\frac{\partial^2\varphi}{\partial\phi_4^2} & \frac{\hbar^2}{E_P^2}\frac{\partial\varphi}{\partial\phi_3}\frac{\partial\varphi}{\partial\phi_4} & \frac{\hbar^2}{E_P^2}\frac{\partial\varphi}{\partial\phi_2}\frac{\partial\varphi}{\partial\phi_4} & \frac{\hbar^2}{E_P^2}\frac{\partial\varphi}{\partial\phi_1}\frac{\partial\varphi}{\partial\phi_4} \\ -\frac{\hbar^2}{E_P^2}\frac{\partial\varphi}{\partial\phi_3}\frac{\partial\varphi}{\partial\phi_4} & -\frac{\hbar^2}{E_P^2}\frac{\partial^2\varphi}{\partial\phi_3^2} & -\frac{\hbar^2}{E_P^2}\frac{\partial\varphi}{\partial\phi_3}\frac{\partial\varphi}{\partial\phi_2} & -\frac{\hbar^2}{E_P^2}\frac{\partial\varphi}{\partial\phi_3}\frac{\partial\varphi}{\partial\phi_1} \\ -\frac{\hbar^2}{E_P^2}\frac{\partial\varphi}{\partial\phi_2}\frac{\partial\varphi}{\partial\phi_4} & -\frac{\hbar^2}{E_P^2}\frac{\partial\varphi}{\partial\phi_3}\frac{\partial\varphi}{\partial\phi_2} & -\frac{\hbar^2}{E_P^2}\frac{\partial^2\varphi}{\partial\phi_2^2} & -\frac{\hbar^2}{E_P^2}\frac{\partial\varphi}{\partial\phi_2}\frac{\partial\varphi}{\partial\phi_1} \\ -\frac{\hbar^2}{E_P^2}\frac{\partial\varphi}{\partial\phi_1}\frac{\partial\varphi}{\partial\phi_4} & -\frac{\hbar^2}{E_P^2}\frac{\partial\varphi}{\partial\phi_3}\frac{\partial\varphi}{\partial\phi_1} & -\frac{\hbar^2}{E_P^2}\frac{\partial\varphi}{\partial\phi_2}\frac{\partial\varphi}{\partial\phi_1} & -\frac{\hbar^2}{E_P^2}\frac{\partial^2\varphi}{\partial\phi_1^2} \end{pmatrix} \tag{2.1.2}$$

2.2 Covariant field equation

From all those relation i can create a field equation, first i write a scalar that will be useful to connect energy tensor with metric tensor that is equal to:

$$\kappa = 1 + \frac{1}{\sqrt{T_\mu \cdot T_\mu \cdot T_\nu \cdot T_\nu}} - \frac{1}{\sqrt{T_\mu \cdot T_\mu}} - \frac{1}{\sqrt{T_\nu \cdot T_\nu}} \tag{2.2.1}$$

That scalar multiply by energy tensor is equal to metric tensor so it creates a field equation in covariant for that is equal to:

$$\kappa T_{\mu\nu} - \frac{1}{r^2} g_{\mu\nu} = 0 \tag{2.2.2}$$

From it follow that first wave tensor field is equal to zero so i can add it to get final field equation in covariant form:

$$\boxed{\kappa T_{\mu\nu} - \frac{1}{r^2} g_{\mu\nu} + \Psi_{\mu\nu} = 0} \tag{2.2.3}$$

This is field equation for one system only- it can be extend to many systems by, first writing wave tensor with more indexes, if i write in it in form of n indexes i get:

$$\begin{aligned} \Psi_{\mu\nu\ldots\mu_n\nu_n} &= \partial_\mu \partial_\nu \ldots \partial_{\mu_n} \partial_{\nu_n} \left(\Psi_\mu \cdot \Psi_\nu \ldots \cdot \Psi_{\mu_n} \cdot \Psi_{\nu_n}\right) \\ &+ \frac{1}{2^n}\left[\left(T_\mu \cdot T_\mu + T_\nu \cdot T_\nu\right) \ldots \left(T_{\mu_n} \cdot T_{\mu_n} + T_{\nu_n} \cdot T_{\nu_n}\right)\left(\Psi_\mu \cdot \Psi_\nu \ldots \cdot \Psi_{\mu_n} \cdot \Psi_{\nu_n}\right)\right] \end{aligned} \tag{2.2.4}$$

Energy tensor can be extended same way, i just need to use vectors T with only first index that has change in sign so i get:

$$T_{\mu\nu\ldots\mu_n\nu_n} = T_\mu \otimes T_\nu \otimes \ldots T_{\mu_n} \otimes T_{\nu_n} = \begin{pmatrix} \frac{\hbar}{E_P}\frac{\partial\varphi(\phi_1,\phi_2,\phi_3,\phi_4)}{\partial\phi_4} \\ -\frac{\hbar}{E_P}\frac{\partial\varphi(\phi_1,\phi_2,\phi_3,\phi_4)}{\partial\phi_3} \\ -\frac{\hbar}{E_P}\frac{\partial\varphi(\phi_1,\phi_2,\phi_3,\phi_4)}{\partial\phi_2} \\ -\frac{\hbar}{E_P}\frac{\partial\varphi(\phi_1,\phi_2,\phi_3,\phi_4)}{\partial\phi_1} \end{pmatrix}_1 \otimes \begin{pmatrix} \frac{\hbar}{E_P}\frac{\partial\varphi(\phi_1,\phi_2,\phi_3,\phi_4)}{\partial\phi_4} \\ \frac{\hbar}{E_P}\frac{\partial\varphi(\phi_1,\phi_2,\phi_3,\phi_4)}{\partial\phi_3} \\ \frac{\hbar}{E_P}\frac{\partial\varphi(\phi_1,\phi_2,\phi_3,\phi_4)}{\partial\phi_2} \\ \frac{\hbar}{E_P}\frac{\partial\varphi(\phi_1,\phi_2,\phi_3,\phi_4)}{\partial\phi_1} \end{pmatrix}_1 \ldots \tag{2.2.5}$$

$$\otimes \begin{pmatrix} \frac{\hbar}{E_P}\frac{\partial\varphi(\phi_1,\phi_2,\phi_3,\phi_4)}{\partial\phi_4} \\ \frac{\hbar}{E_P}\frac{\partial\varphi(\phi_1,\phi_2,\phi_3,\phi_4)}{\partial\phi_3} \\ \frac{\hbar}{E_P}\frac{\partial\varphi(\phi_1,\phi_2,\phi_3,\phi_4)}{\partial\phi_2} \\ \frac{\hbar}{E_P}\frac{\partial\varphi(\phi_1,\phi_2,\phi_3,\phi_4)}{\partial\phi_1} \end{pmatrix}_n \otimes \begin{pmatrix} \frac{\hbar}{E_P}\frac{\partial\varphi(\phi_1,\phi_2,\phi_3,\phi_4)}{\partial\phi_4} \\ \frac{\hbar}{E_P}\frac{\partial\varphi(\phi_1,\phi_2,\phi_3,\phi_4)}{\partial\phi_3} \\ \frac{\hbar}{E_P}\frac{\partial\varphi(\phi_1,\phi_2,\phi_3,\phi_4)}{\partial\phi_2} \\ \frac{\hbar}{E_P}\frac{\partial\varphi(\phi_1,\phi_2,\phi_3,\phi_4)}{\partial\phi_1} \end{pmatrix}_n \tag{2.2.6}$$

Matrix subscripts denotes that it's n vector. Same idea has to be used for metric tensor, i use vectors g this time:

$$g_{\mu\nu\ldots\mu_n\nu_n} = g_\mu \otimes g_\nu \otimes \ldots g_{\mu_n} \otimes g_{\nu_n}$$

$$g_{\mu\nu\ldots\mu_n\nu_n} = \begin{pmatrix} r\left(1-\sqrt{T_0\cdot T_0}\right) \\ -r\left(1-\sqrt{T_1\cdot T_1}\right)\sin(\phi_4) \\ -r\left(1-\sqrt{T_2\cdot T_2}\right)\sin(\phi_4)\sin(\phi_3) \\ -r\left(1-\sqrt{T_3\cdot T_3}\right)\sin(\phi_4)\sin(\phi_3)\sin(\phi_2) \end{pmatrix} \otimes \begin{pmatrix} r\left(1-\sqrt{T_0\cdot T_0}\right) \\ r\left(1-\sqrt{T_1\cdot T_1}\right)\sin(\phi_4) \\ r\left(1-\sqrt{T_2\cdot T_2}\right)\sin(\phi_4)\sin(\phi_3) \\ r\left(1-\sqrt{T_3\cdot T_3}\right)\sin(\phi_4)\sin(\phi_3)\sin(\phi_2) \end{pmatrix} \ldots$$

$$\otimes \begin{pmatrix} r\left(1-\sqrt{T_0\cdot T_0}\right) \\ r\left(1-\sqrt{T_1\cdot T_1}\right)\sin(\phi_4) \\ r\left(1-\sqrt{T_2\cdot T_2}\right)\sin(\phi_4)\sin(\phi_3) \\ r\left(1-\sqrt{T_3\cdot T_3}\right)\sin(\phi_4)\sin(\phi_3)\sin(\phi_2) \end{pmatrix}_n \otimes \begin{pmatrix} r\left(1-\sqrt{T_0\cdot T_0}\right) \\ r\left(1-\sqrt{T_1\cdot T_1}\right)\sin(\phi_4) \\ r\left(1-\sqrt{T_2\cdot T_2}\right)\sin(\phi_4)\sin(\phi_3) \\ r\left(1-\sqrt{T_3\cdot T_3}\right)\sin(\phi_4)\sin(\phi_3)\sin(\phi_2) \end{pmatrix}_n$$

Now i can write field equation for n systems as:

$$\kappa^n T_{\mu\nu\ldots\mu_n\nu_n} - \frac{1}{r^{2n}} g_{\mu\nu\ldots\mu_n\nu_n} + \Psi_{\mu\nu\ldots\mu_n\nu_n} = 0 \tag{2.2.7}$$

And finally constant kappa is equal to:

$$\kappa^n = \kappa_1\ldots\kappa_n = \left(1+\frac{1}{\sqrt{T_\mu\cdot T_\mu\cdot T_\nu\cdot T_\nu}} - \frac{1}{\sqrt{T_\mu\cdot T_\mu}} - \frac{1}{\sqrt{T_\nu\cdot T_\nu}}\right)\ldots$$
$$\left(1+\frac{1}{\sqrt{T_{\mu_n}\cdot T_{\mu_n}\cdot T_{\nu_n}\cdot T_{\nu_n}}} - \frac{1}{\sqrt{T_{\mu_n}\cdot T_{\mu_n}}} - \frac{1}{\sqrt{T_{\nu_n}\cdot T_{\nu_n}}}\right)$$

This is field equation in covariant form for n body system. Field equation connects energy tensor with metric tensor thus it gives zero, field equation states that wave tensor is equal to zero so i can add it to make final field equation. For n body system rule with only first index changes sign stay to make equality. Field equation can be written in contravariant form but it has no physical meaning, physical meaning of field equation is that for any given energy there is a metric matching that energy state, and from that energy state there comes a wave function tensor solution. It means if energy is defined- so is movement there is always one metric matching it. So for each energy state there is unique space-time geometry state and there is unique wave tensor solutions. It physically means that system will always have definite state in space-time, when energy of that state is defined.

2.3 Field equation simplest solution

Field equation can be easy solve using exponential function with imaginary unit. I this subsection i will show simplest solutions for one body system. They take form of:

$$\Psi_{\mu\nu}(\phi_4,\phi_3,\phi_2,\phi_1) = c_\mu(\phi_3,\phi_2,\phi_1)c_\nu(\phi_3,\phi_2,\phi_1)e^{\pm\frac{1}{2}i\phi_\mu\cdot T_\mu}e^{\pm\frac{1}{2}i\phi_\nu\cdot T_\nu} \tag{2.3.1}$$

Where ϕ is spherical coordinate. I will assume simple solutions where i take into account only diagonal elements of metric. So this solution reduces to:

$$\Psi_{\mu\nu}(\phi_4,\phi_3,\phi_2,\phi_1) = c_\mu^2(\phi_3,\phi_2,\phi_1)e^{\pm i\phi_\mu\cdot T_\mu}\Big|_{\mu=\nu} \tag{2.3.2}$$

I can write metric for this solution as, where $r^2 = c^2t^2$:

$$ds^2 = c^2t^2\left[\left(1-\sqrt{T_0\cdot T_0}\right)^2 d\phi_4^2 - \left(1-\sqrt{T_1\cdot T_1}\right)^2\sin^2(\phi_4)d\phi_3^2 - \left(1-\sqrt{T_2\cdot T_2}\right)^2\sin^2(\phi_4)\sin^2(\phi_3)d\phi_2^2\right]$$
$$-c^2t^2\left(1-\sqrt{T_3\cdot T_3}\right)^2\sin^2(\phi_4)\sin^2(\phi_3)\sin^2(\phi_2)d\phi_1^2$$

Those are simplest form of solutions for one body system, constant functions of angle depend problem and they are arbitrary. In simplest case they are just equal to one. Energy tensor components are equal to:

$$T_{00} = \frac{\hbar^2}{E_P^2}\frac{\partial^2\varphi(\phi_1,\phi_2,\phi_3,\phi_4)}{\partial\phi_4^2} = \left(\frac{Ml_P}{m_PR}\right)^2 \tag{2.3.3}$$

$$T_{kk} = -\frac{\hbar^2}{E_P^2}\frac{\partial^2\varphi(\phi_1,\phi_2,\phi_3,\phi_4)}{\partial\phi_k^2} = -\left(\frac{p_kl_P}{p_PR}\right)^2 \tag{2.3.4}$$

Where M is mass, l_P is Planck length , m_P is Planck mass , p_P is Planck momentum and R is radius from that mass or momentum. Those solutions come from black holes- idea is that for one Planck mass there is one Planck length. So for a black hole there is mass in Planck units times Planck length, more mass means multiply Planck length by number of Planck masses. Radius is how far away from mass object is- this solution can be used not only for black holes but for any gravity system and it's simplest solution to field equations.

Section 3: Field equation predictions

3.1 Cosmological model

From those field equations there can be construct a simple cosmological model. Universe can expand , collapse or stay static. If it expands there is more energy in expansion than in matter, so it leads to so called dark energy. I can calculate first a cosmological parameter that is equal to square root of energy tensor 00 component:

$$\Gamma = \sqrt{T_{00}} = \frac{M l_P}{m_P R} \tag{3.1.1}$$

Now i can plug this parameter to metric so i get:

$$\frac{1}{r^2} g_{00} = \left(1 - \Gamma\right)^2 = 1 + \Gamma^2 - 2\Gamma \tag{3.1.2}$$

Because this parameter is in square form (metric is in square form) i need to take square root of it:

$$A = \sqrt{1 + \Gamma^2 - 2\Gamma} \tag{3.1.3}$$

If this parameter is equal to more than one half universe is expanding, if it's one half universe is equal to black hole horizon so it's static if it's less then its collapsing. For our universe it's equal to about 0.7 it means universe is expanding. This parameter is equal to amount of dark energy compared to matter energy. It explains why for one half universe is static- energy of expansion and matter cancel out, if there is less dark energy so this parameter is less than one half universe will contract. For our universe there is about 70 procent of dark energy so universe will expand and about 30 procent of matter. Matter content relative to dark energy is just one minus A:

$$A_m = 1 - A \tag{3.1.4}$$

This model does not take into account momentum and other than 00 components of energy and metric but it's a good approximation for universe where momentum energy is low compared to gravity generated by mass.

3.2 Black holes

Black holes are most extreme test of gravity theory in nature. For black holes there are two most important regions, first one is event horizon, second one is black hole singularity. I will focus on explain how for simplest solutions those two regions work in that idea. First let start with event horizon, for observer that is only moving with gravity of black hole i calculate only one spacial component, from point of view of falling observer it does not move in space, space is moving. That's why i calculate only first component of metric and energy tensors. Metric tensor for time component will give one half, when square rooted:

$$g_{11} = c^2 t^2 \left(1 - 2\left(\frac{p_1 l_P}{p_P R}\right) + \left(\frac{p_1 l_P}{p_P R}\right)^2\right) = \frac{1}{4} c^2 t^2 \tag{3.2.1}$$

$$\sqrt{g_{11}} = \frac{1}{2} c t \tag{3.2.2}$$

From point of view of falling observer time flows normally so i calculate only change in coordinate of space, one half i get is from idea that momentum of falling object is equal to energy of black - thus first time component:

$$\frac{p_1 l_P}{p_P R} = \frac{M l_P}{m_P R} \tag{3.2.3}$$

So at event horizon falling observe moves with half speed of light. Now i can calculate relative change for observer that is not moving relative to falling observer using transform (1.2.1), (1.2.2):

$$d\phi_4' = \cos((\pi\sqrt{T_0' \cdot T_0'}) - \pi\sqrt{T_0 \cdot T_0}) d\phi_4 = \cos((\pi\frac{1}{2}) - 0) d\phi_4 = 0 \tag{3.2.4}$$

$$d\phi_1' = \sec((\pi\sqrt{T_0' \cdot T_0'}) - \pi\sqrt{T_0 \cdot T_0}) d\phi_1 = \sec((\pi\frac{1}{2}) - 0) d\phi_1 = \infty d\phi_1 \tag{3.2.5}$$

That is well known result from General Relativity. Time stops and space gets infinite. It happens only for observer that is not moving relative for observer falling into a black hole. If there is another observer moving but slower it will not see infinite amount of space and zero pass of time, it comes from fact that angle will be not half o π but half minus angle of moving slower observer. Another region that is important is singularity of a black hole. First it gives Planck energy, so both momentum and energy are equal to one:

$$\frac{p_1 l_P}{p_P R} = \frac{M l_P}{m_P R} = 1 \tag{3.2.6}$$

It means both metric components are equal to zero, $g_{00} = g_{11} = 0$- it means light cones are frozen and not moving. But there can be still movement that will give zero, if fourth angle $\sin(\phi_4) = 0$ is equal to zero there can be non-zero movement in $d\phi_2, d\phi_1$ coordinates it's first case. Second case is when there is non-zero fourth coordinate but zero angle of third coordinate $\sin(\phi_3) = 0$, last case when only when there is movement in only first coordinate then one of angles $\sin(\phi_4)$ or $\sin(\phi_3)$ or $\sin(\phi_2)$ has to be equal to zero. It means there is still movement inside a black hole that is point like for one of three coordinates (ϕ_4, ϕ_3, ϕ_2), and does move in loops for another ones. Relative length transform will give minus one for observer that is not moving relative to inside of a black hole:

$$d\phi_4' = \cos((\pi\sqrt{T_0'\cdot T_0'}) - \pi\sqrt{T_0\cdot T_0})d\phi_4 = \cos((\pi) - 0)d\phi_4 = -d\phi_4 \tag{3.2.7}$$

$$d\phi_1' = \sec((\pi\sqrt{T_0'\cdot T_0'}) - \pi\sqrt{T_0\cdot T_0})d\phi_1 = \sec((\pi) - 0)d\phi_1 = -d\phi_1 \tag{3.2.8}$$

It means time from point of view of distant observer goes backwards and space does behave like time. So inside a black hole there are loops that always point to point for one coordinate $\left(\sin(\phi_4), \sin(\phi_3), \sin(\phi_2)\right)$ and point in any direction for rest of coordinates, it depends on momentum direction. So i can write metric for inside of a black hole as:

$$ds^2 = c^2t^2\left[\left(1-\sqrt{T_0\cdot T_0}\right)^2 d\phi_4^2 - \left(1-\sqrt{T_1\cdot T_1}\right)^2 \sin^2(\phi_4)d\phi_3^2 - \left(1-\sqrt{T_2\cdot T_2}\right)^2 \sin^2(\phi_4)\sin^2(\phi_3)d\phi_2^2\right] \\ - c^2t^2\left(1-\sqrt{T_3\cdot T_3}\right)^2 \sin^2(\phi_4)\sin^2(\phi_3)\sin^2(\phi_2)d\phi_1^2 = 0$$

3.3 General field equation

Field equation can be extended for not only gravity systems. Normally energy is equal to metric, it means all energy goes into curvature of space-time, but if i add another term right side of equation there will be more or less energy than in curvature of space-time depending on sign of that object, i can write it as:

$$\kappa T_{\mu\nu} - \frac{1}{r^2} g_{\mu\nu} + \Psi_{\mu\nu} = \gamma K_{\mu\nu} \tag{3.3.1}$$

$$\kappa T_{\mu\nu} - \frac{1}{r^2} g_{\mu\nu} + \Psi_{\mu\nu} - \gamma K_{\mu\nu} = 0 \tag{3.3.2}$$

Now field equation is extended to systems that have energy other than stored in curvature of space-time. Constant γ is same like constant κ but with $K_{\mu\nu}$ components:

$$\gamma = 1 + \frac{1}{\sqrt{K_\mu \cdot K_\mu \cdot K_\nu \cdot K_\nu}} - \frac{1}{\sqrt{K_\mu \cdot K_\mu}} - \frac{1}{\sqrt{K_\nu \cdot K_\nu}} \tag{3.3.3}$$

Addition to general field equations are symmetries, first symmetry states that system is massless $ds^2 = 0$ second one that $K_{\mu\nu}$ tensor is equal to zero or greater: $K_{\mu\nu} \geq 0$. Those symmetries can be wrote as pairs:

$$S_a = \Big((S_1 + S_2), (-S_1 + S_2), (S_1 - S_2), (-S_1 - S_2) \Big) \tag{3.3.4}$$

Key idea is that for any given system there is conservation of those symmetries so if i sum them for any system the will not change when system changes:

$$\sum_a S_a = (S_1 + S_2) + (-S_1 + S_2) + (S_1 - S_2) + (-S_1 - S_2) = constant \tag{3.3.5}$$

This conservation of symmetries is key idea in extending general field equation. Symmetry can have value of one , minus one or zero. That means its fulfilled for one, not fulfilled for minus one, or not taken into account for zero. Those symmetries are just field equation solutions and idea is to group those solutions into symmetry and conserve them.

Section 4: Summary

In this paper i presented mathematical model for gravity that is special spherical space-time, this model gives predictions very close to General Relativity solutions. It correctly predicts ratio between dark energy and matter for current universe. General idea is very simple i take 4-sphere metric and threat fourth coordinate as time, from that i create equations of motion for change in angle that leads to covariant field connected to metric tensor. Those equations leads to cyclic covariant functions that are wave tensor field solutions.

Physical meaning if that time is not a line but part of 4-sphere circle, so angle of rotation is not only in space but in time. That means object with high gravitational energy can point in many direction of time at once from our point of view- because radius of that 4-sphere gets bigger with each second from a our point of view those object move forward in time we don't see rotation in time. But if we try to measure for example position of electron wave function is just statement that we don't know electron position in time and same with space, so electrons and any other quantum particle are pointing in many directions of space and time thus it lead to uncertainty in their position- wave function from quantum mechanics. This model maybe solution to wave function problem. It leads to idea that quantum objects because operate on small time scales tend to move from our point of view in many directions of space and time at once, effect is same like if we applied a wave function. When we do measurement there is no real collapse of wave function we just find in what direction real particle is pointing in space and time.

This model does not break at Planck energy level and leads to loops in space-time inside a black hole. I presented simplest solutions for black holes, meaning of it is that from inside of a black hole we can access points that normally are beyond our light cone reach. It happens because all light-cones are frozen so we can reach light cone that is in our past of future from inside of a black hole. Real black holes are more complex but this general rule apply to them as well.

General rule behind wave field equation is that gravity is equal to motion in any direction, that motion is always accelerated, non accelerated motion does not change energy of a system thus it does not lead to change in it's gravity effect. That simple statement lead to very simple solutions for wave field covariant tensor i presented in this paper.