How to quantize gravity, space, and time

David B. Parker daveparker@pgu.org APS Global Physics Summit, March 15-20, 2026

pgu.org

Talk:

Overview

pgu.org

General relativity, while mostly nonlinear, happens to be linear with respect to certain sets of partial derivatives. We can exploit one of those linear sets in order to quantize gravity, space, and time.

The symmetric metric tensor $g_{\alpha\beta}$ in 4x4 matrix format (omitting the redundant symmetric elements) is:

$$g_{\alpha\beta} = \begin{bmatrix} g_{00} & & & \\ g_{10} & g_{11} & & \\ g_{20} & g_{21} & g_{22} & \\ g_{30} & g_{31} & g_{32} & g_{33} \end{bmatrix}. \tag{1}$$

Using x^0 as our time coordinate, the linear set of partial derivatives we are going to exploit is:

$$D_{\alpha\beta} = \begin{bmatrix} \partial_0 g_{00} & & & \\ \partial_0 g_{10} & \partial^2_{00} g_{11} & & \\ \partial_0 g_{20} & \partial^2_{00} g_{21} & \partial^2_{00} g_{22} & \\ \partial_0 g_{30} & \partial^2_{00} g_{31} & \partial^2_{00} g_{32} & \partial^2_{00} g_{33} \end{bmatrix}, \quad \text{where } \partial_0 g_{00} = \frac{\partial g_{00}}{\partial x^0}, \text{ etc.} \tag{2}$$

The derivatives of g_{00}, g_{10}, g_{20}, g_{30} are only 1st order because general relativity does not contain their 2nd order derivatives.

We can use ordinary linear algebra to solve general relativity for these derivatives. We can then convert partial derivatives into total derivatives by setting the coordinate system to absolute space and time. This exactly embeds general relativity into absolute space and time, which enables us to quantize gravity, space, and time.

Start from Einstein's equation

pgu.org

Start from Einstein's equation for general relativity:

$$R_{\alpha\beta} - \tfrac{1}{2}\, g_{\alpha\beta} R = (8\pi K/c^4) T_{\alpha\beta}. \tag{3}$$

$R_{\alpha\beta}$ is the Ricci tensor, $g_{\alpha\beta}$ is the symmetric metric tensor, R is the Ricci scalar, K is the gravitational constant, c is the speed of light, and $T_{\alpha\beta}$ is the energy-momentum-stress tensor. $T_{\alpha\beta}$ is where electromagnetism lives.

To simplify notation, define $G_{\alpha\beta}$ to be the left hand side of Einstein's equation, and define $U_{\alpha\beta}$ to be the right hand side:

$$G_{\alpha\beta} = R_{\alpha\beta} - \frac{1}{2} g_{\alpha\beta} R, \qquad U_{\alpha\beta} = (8\pi K/c^4) T_{\alpha\beta}. \tag{4}$$

Substituting into Equation (3) gives the simplified Einstein equation:

$$G_{\alpha\beta} = U_{\alpha\beta}. \tag{5}$$

We can give labels to each element of $G_{\alpha\beta}$ and $U_{\alpha\beta}$, then display them in 4x4 matrix format as:

$$G_{\alpha\beta} = \begin{bmatrix} G_{00} & & & \\ G_{10} & G_{11} & & \\ G_{20} & G_{21} & G_{22} & \\ G_{30} & G_{31} & G_{32} & G_{33} \end{bmatrix}, \qquad U_{\alpha\beta} = \begin{bmatrix} U_{00} & & & \\ U_{10} & U_{11} & & \\ U_{20} & U_{21} & U_{22} & \\ U_{30} & U_{31} & U_{32} & U_{33} \end{bmatrix}. \tag{6}$$

Pack the symmetric 4x4 matrices into 10-vectors

pgu.org

$D_{\alpha\beta}$, $G_{\alpha\beta}$, and $U_{\alpha\beta}$ are symmetric, so instead of 16 independent elements, each has only 10 independent elements. Put the 10 independent elements into 10-vectors $\mathbf{d}$, $\mathbf{g}$, and $\mathbf{u}$:

$$D_{\alpha\beta} \to \mathbf{d} = \begin{bmatrix} \partial_0 g_{00} \\ \partial_0 g_{10} \\ \partial_0 g_{20} \\ \partial_0 g_{30} \\ \partial^2_{00} g_{11} \\ \partial^2_{00} g_{22} \\ \partial^2_{00} g_{33} \\ \partial^2_{00} g_{21} \\ \partial^2_{00} g_{31} \\ \partial^2_{00} g_{32} \end{bmatrix}, \qquad G_{\alpha\beta} \to \mathbf{g} = \begin{bmatrix} G_{00} \\ G_{10} \\ G_{20} \\ G_{30} \\ G_{11} \\ G_{22} \\ G_{33} \\ G_{21} \\ G_{31} \\ G_{32} \end{bmatrix}, \qquad U_{\alpha\beta} \to \mathbf{u} = \begin{bmatrix} U_{00} \\ U_{10} \\ U_{20} \\ U_{30} \\ U_{11} \\ U_{22} \\ U_{33} \\ U_{21} \\ U_{31} \\ U_{32} \end{bmatrix}. \tag{7}$$

Substitute $\mathbf{g}$ and $\mathbf{u}$ into the simplified Einstein equation $G_{\alpha\beta} = U_{\alpha\beta}$ to get the vector Einstein equation:

$$\mathbf{g} = \mathbf{u}. \tag{8}$$

Solve for the time derivatives

pgu.org

The linearity of general relativity in $\mathbf{d}$ means that $\mathbf{g}$ and $\mathbf{u}$ can be written as linear equations in $\mathbf{d}$:

$$\mathbf{g} = \mathbf{M}\mathbf{d} + \mathbf{m}, \qquad \mathbf{u} = \mathbf{N}\mathbf{d} + \mathbf{n}, \tag{9}$$

where $\mathbf{M}$ and $\mathbf{N}$ are 10x10 matrices, and $\mathbf{m}$ and $\mathbf{n}$ are 10-vectors. Plug these expressions for $\mathbf{g}$ and $\mathbf{u}$ into the vector Einstein equation $\mathbf{g} = \mathbf{u}$:

$$\mathbf{M}\mathbf{d} + \mathbf{m} = \mathbf{N}\mathbf{d} + \mathbf{n}. \tag{10}$$

Use linear algebra to solve for $\mathbf{d}$:

$$\mathbf{d} = (\mathbf{M} - \mathbf{N})^{-1}(\mathbf{n} - \mathbf{m}) \tag{11}$$

Let $\mathbf{i}$ be the interaction terms on the right side:

$$\mathbf{i} = (\mathbf{M} - \mathbf{N})^{-1}(\mathbf{n} - \mathbf{m}). \tag{12}$$

Susbstitute $\mathbf{i}$ into (11) to get the solved Einstein equation:

$$\mathbf{d} = \mathbf{i}. \tag{13}$$

Unpack the 10-vectors into symmetric 4x4 matrices

pgu.org

Unpack the 10-vectors of derivatives $\mathbf{d}$ and interaction terms $\mathbf{i}$ into symmetric 4x4 matrices $\mathbf{D}$ and $\mathbf{I}$, then relabel the elements and write them in block matrix form:

$$\mathbf{D} = \begin{bmatrix} \partial_0 g_{00} & & & \\ \partial_0 g_{10} & \partial^2_{00} g_{11} & & \\ \partial_0 g_{20} & \partial^2_{00} g_{21} & \partial^2_{00} g_{22} & \\ \partial_0 g_{30} & \partial^2_{00} g_{31} & \partial^2_{00} g_{32} & \partial^2_{00} g_{33} \end{bmatrix} = \begin{bmatrix} \partial_0 g & & & \\ \partial_0 w_1 & \partial^2_{00} S_{11} & & \\ \partial_0 w_2 & \partial^2_{00} S_{21} & \partial^2_{00} S_{22} & \\ \partial_0 w_3 & \partial^2_{00} S_{31} & \partial^2_{00} S_{32} & \partial^2_{00} S_{33} \end{bmatrix} = \begin{bmatrix} \partial_0 g & \\ \partial_0 \mathbf{w} & \partial^2_{00} \mathbf{S} \end{bmatrix}, \tag{14}$$

$$\mathbf{I} = \begin{bmatrix} \mathbf{i}_0 & & & \\ \mathbf{i}_1 & \mathbf{i}_4 & & \\ \mathbf{i}_2 & \mathbf{i}_7 & \mathbf{i}_5 & \\ \mathbf{i}_3 & \mathbf{i}_8 & \mathbf{i}_9 & \mathbf{i}_6 \end{bmatrix} = \begin{bmatrix} g_{\mathbf{i}} & & & \\ w_{\mathbf{i}_1} & S_{\mathbf{i}_{11}} & & \\ w_{\mathbf{i}_2} & S_{\mathbf{i}_{21}} & S_{\mathbf{i}_{22}} & \\ w_{\mathbf{i}_3} & S_{\mathbf{i}_{31}} & S_{\mathbf{i}_{32}} & S_{\mathbf{i}_{33}} \end{bmatrix} = \begin{bmatrix} g_{\mathbf{i}} & \\ \mathbf{w}_{\mathbf{i}} & \mathbf{S}_{\mathbf{i}} \end{bmatrix}. \tag{15}$$

Equate corresponding blocks in $\mathbf{D}$ and $\mathbf{I}$ to get the unpacked Einstein equations:

$$\partial_0 g = g_{\mathbf{i}}, \qquad \partial_0 \mathbf{w} = \mathbf{w}_{\mathbf{i}}, \qquad \partial^2_{00} \mathbf{S} = \mathbf{S}_{\mathbf{i}}. \tag{16}$$

Set the coordinate system to absolute space and time

pgu.org

Einstein's equation is valid in any coordinate system, so set the coordinate system to absolute space and time:

$$x^\delta = [ct, x, y, z]^\intercal. \tag{17}$$

In absolute space and time the coordinates do not vary with respect to each other:

$$\frac{dx^\gamma}{dx^\delta} = \begin{cases} 1, & \text{if } \gamma = \delta, \\ 0, & \text{if } \gamma \neq \delta. \end{cases} \tag{18}$$

1st partial derivatives become 1st total derivatives. To see this, use the standard formula for total derivatives and apply (18):

$$\frac{dg_{\mu\nu}}{dx^\alpha} = \frac{\partial g_{\mu\nu}}{\partial x^0}\frac{dx^0}{dx^\alpha} + \frac{\partial g_{\mu\nu}}{\partial x^1}\frac{dx^1}{dx^\alpha} + \frac{\partial g_{\mu\nu}}{\partial x^2}\frac{dx^2}{dx^\alpha} + \frac{\partial g_{\mu\nu}}{\partial x^3}\frac{dx^3}{dx^\alpha} = \frac{\partial g_{\mu\nu}}{\partial x^\alpha}. \tag{19}$$

Similarly for 2nd derivatives. Substitute total derivatives for the partial derivatives in the unpacked Einstein equations (16) (including those inside the interaction terms $g_{\mathbf{i}}$, $\mathbf{w}_{\mathbf{i}}$, and $\mathbf{S}_{\mathbf{i}}$), and substitute $x^0 = ct$ from (17), to convert the unpacked Einstein equations into ordinary three-dimensional differential field equations, with time t as the independent variable:

$$\frac{1}{c}\frac{dg}{dt} = g_{\mathbf{i}}, \qquad \frac{1}{c}\frac{d\mathbf{w}}{dt} = \mathbf{w}_{\mathbf{i}}, \qquad \frac{1}{c^2}\frac{d^2\mathbf{S}}{dt^2} = \mathbf{S}_{\mathbf{i}}. \tag{20}$$

We have reached our goal; these equation exactly embed general relativity into absolute space and time. We get exactly back to Einstein's equation if we exactly reverse the steps we took to get here.

Discussion

pgu.org

The field equations (20) are the fundamental equations of quantum gravity. They reduce general relativity from the tensor mathematics of curved spacetime to the scalar/vector/matrix mathematics of classical mechanics. They unite Maxwell's electromagnetism with Einstein's general relativity in Newton's absolute space and time.

The field equations (20) generate three new kinds of gravitons: scalar g gravitons, vector $\mathbf{w}$ gravitons, and matrix $\mathbf{S}$ gravitons. g, $\mathbf{w}$, and $\mathbf{S}$ stand for *g*ravitational, **w**eak, and **S**trong. The equations for the g and $\mathbf{w}$ gravitons go as d/dt, so they are diffusive or Schrödinger like. The equation for the $\mathbf{S}$ gravitons goes as d^2/dt^2, so they are wavelike or Klein-Gordon like.

The three new kinds of gravitons appear as a natural consequence of exactly embedding general relativity into absolute space and time. Unconstrained general relativity uses curved spacetime to transmit gravity. Constrained to absolute space and time, the three new kinds of gravitons mathematically pop into existence to transmit gravity.

Exactly embedding general relativity into absolute space and time also makes it straightforward to quantize space and time. Both can be quantized by using fixed step sizes. Natural choices for the space and time steps would be the Planck distance and the Planck time. Quantized space and time make it possible to simulate our universe.

For further discussion, including experimental evidence, see "Absolute quantum gravity (AQG)", preprint, 2026-02-28, https://pgu.org/absolutequantumgravity_v1.pdf

pgu.org

Paper:

Absolute quantum gravity (AQG)

David B. Parker*
pgu.org

(Dated: February 28, 2026)

General relativity is linear with respect to certain subsets of the partial derivatives of the elements of the symmetric metric tensor $g_{\alpha\beta}$. We can quantize gravity by exploiting one of those linear subsets. The linear subset we will exploit is composed of the following ten partial derivatives of the ten independent elements of $g_{\alpha\beta}$ with respect to the time coordinate x_0: $\partial_0 g_{00}$, $\partial_0 g_{10}$, $\partial_0 g_{20}$, $\partial_0 g_{30}$, $\partial^2_{00} g_{11}$, $\partial^2_{00} g_{22}$, $\partial^2_{00} g_{33}$, $\partial^2_{00} g_{21}$, $\partial^2_{00} g_{31}$, and $\partial^2_{00} g_{32}$. We can exactly solve general relativity for these ten partial derivatives using ordinary linear algebra. We can then convert the partial derivatives into total derivatives by setting the coordinate system to absolute space and time. The result is a system of ten ordinary differential equations that exactly embed general relativity into absolute three-dimensional space with absolute time, à la classical mechanics. These ten equations split naturally into three sets of field equations for three new kinds of gravitons. Space and time can also be quantized. There are many consequences of absolute quantum gravity (AQG). AQG predicts a relationship between the weak force and local angular momentum that violates the standard model and is a signature of AQG. At least two experiments may have already seen this signature of AQG: He, et al.[2005,2009] and Ding, et al.[2007,2008,2009], who measured variations in radioactive decay with respect to local angular momentum. More experiments and more detailed calculations are needed to confirm AQG.

I. INTRODUCTION

General relativity is linear with respect to certain subsets of the partial derivatives of the elements of the symmetric metric tensor $g_{\alpha\beta}$. We can quantize gravity by exploiting one of those linear subsets. The linear subset we will exploit is composed of the following ten partial derivatives of the ten independent elements of $g_{\alpha\beta}$ with respect to the time coordinate x^0:

$$\partial_0 g_{00}, \partial_0 g_{10}, \partial_0 g_{20}, \partial_0 g_{30}, \\ \partial^2_{00} g_{11}, \partial^2_{00} g_{22}, \partial^2_{00} g_{33}, \partial^2_{00} g_{21}, \partial^2_{00} g_{31}, \partial^2_{00} g_{32}. \tag{1}$$

For visual clarity, we can display both $g_{\alpha\beta}$ and these partial derivatives in 4x4 matrix format (omitting redundant symmetric elements):

$$g_{\alpha\beta} = \begin{bmatrix} g_{00} & & & \\ g_{10} & g_{11} & & \\ g_{20} & g_{21} & g_{22} & \\ g_{30} & g_{31} & g_{32} & g_{33} \end{bmatrix}, \tag{2}$$

$$D_{\alpha\beta} = \begin{bmatrix} \partial_0 g_{00} & & & \\ \partial_0 g_{10} & \partial^2_{00} g_{11} & & \\ \partial_0 g_{20} & \partial^2_{00} g_{21} & \partial^2_{00} g_{22} & \\ \partial_0 g_{30} & \partial^2_{00} g_{31} & \partial^2_{00} g_{32} & \partial^2_{00} g_{33} \end{bmatrix}. \tag{3}$$

We can exactly solve general relativity for these ten partial derivatives using ordinary linear algebra.

The subset of partial derivatives (1) has three properties that make exactly solving general relativity both possible and useful. The three properties are:

1. there are ten independent elements, so they span the ten independent equations of general relativity.
2. general relativity is linear with respect to the subset. That is, in the equations of general relativity none of the elements ever appear to any power other than the first (e.g. there are no terms containing $(\partial^2_{00} g_{21})^2$), and no two of the elements are ever multiplied together (e.g. there are no terms containing $\partial_0 g_{00}\, \partial_0 g_{20}$).
3. the subset contains only the 1st order partial derivatives of g_{00}, g_{10}, g_{20}, and g_{30} with respect to x^0 because the equations of general relativity do not contain their 2nd order partial derivatives.

Proofs of the last two properties are in [14]. A supplemental Maxima program is also provided to verify the last two properties[16].

A possibly problematic fourth property of the subset (1) is that the elements do not all have the same units. Some elements are in units proportional to $1/x^0$, and others are in units proportional to $1/(x^0)^2$. However, that turns out to not be a problem because the units propagate correctly through the calculations.

Just to be clear, the word linear in this paper does not refer to any sort of linearized approximation to general relativity, such as the post-Newtonian approximation. We use the word linear to refer to the linearity inherent in general relativity itself. At no point in this paper do we approximate general relativity in any way. All of the calculations are exact.

* daveparker@pgu.org

II. START FROM EINSTEIN'S EQUATION

To exactly embed general relativity into absolute space and time, start from Einstein's equation[4]:

$$R_{\alpha\beta} - \tfrac{1}{2}\, g_{\alpha\beta} R = (8\pi K/c^4) T_{\alpha\beta}, \tag{4}$$

where $R_{\alpha\beta}$ is the Ricci tensor, $g_{\alpha\beta}$ is the symmetric metric tensor, R is the Ricci scalar, K is the gravitational constant, c is the speed of light, and $T_{\alpha\beta}$ is the energy-momentum-stress (EMS) tensor. $T_{\alpha\beta}$ is where electromagnetism lives. Because the symmetric metric tensor $g_{\alpha\beta}$ has ten independent elements, Einstein's equation represents a system of ten independent equations.

To simplify notation, define $G_{\alpha\beta}$ to be the left hand side of Einstein's equation, and define $U_{\alpha\beta}$ to be the right hand side:

$$G_{\alpha\beta} = R_{\alpha\beta} - \frac{1}{2} g_{\alpha\beta} R \tag{5}$$

$$U_{\alpha\beta} = (8\pi K/c^4) T_{\alpha\beta}. \tag{6}$$

$G_{\alpha\beta}$ is often referred to as the Einstein tensor. Substitute $G_{\alpha\beta}$ and $U_{\alpha\beta}$ into Equation (4) to get the simplified Einstein equation:

$$G_{\alpha\beta} = U_{\alpha\beta}. \tag{7}$$

III. PACK SYMMETRIC 4X4 MATRICES INTO 10-VECTORS

For visual clarity, give labels to the elements of the symmetric tensors $G_{\alpha\beta}$ and $U_{\alpha\beta}$, then display them in 4x4 matrix format:

$$G_{\alpha\beta} = \begin{bmatrix} G_{00} & & & \\ G_{10} & G_{11} & & \\ G_{20} & G_{21} & G_{22} & \\ G_{30} & G_{31} & G_{32} & G_{33} \end{bmatrix}, \tag{8}$$

$$U_{\alpha\beta} = \begin{bmatrix} U_{00} & & & \\ U_{10} & U_{11} & & \\ U_{20} & U_{21} & U_{22} & \\ U_{30} & U_{31} & U_{32} & U_{33} \end{bmatrix}. \tag{9}$$

Pack the elements of $D_{\alpha\beta}$ (3), $G_{\alpha\beta}$, and $U_{\alpha\beta}$ into 10-vectors $\mathbf{d}$, $\mathbf{g}$ and $\mathbf{u}$, putting the elements in matching order:

$$\mathbf{d} = \begin{bmatrix} \partial_0 g_{00} \\ \partial_0 g_{10} \\ \partial_0 g_{20} \\ \partial_0 g_{30} \\ \partial^2_{00} g_{11} \\ \partial^2_{00} g_{22} \\ \partial^2_{00} g_{33} \\ \partial^2_{00} g_{21} \\ \partial^2_{00} g_{31} \\ \partial^2_{00} g_{32} \end{bmatrix}, \quad \mathbf{g} = \begin{bmatrix} G_{00} \\ G_{10} \\ G_{20} \\ G_{30} \\ G_{11} \\ G_{22} \\ G_{33} \\ G_{21} \\ G_{31} \\ G_{32} \end{bmatrix}, \quad \mathbf{u} = \begin{bmatrix} U_{00} \\ U_{10} \\ U_{20} \\ U_{30} \\ U_{11} \\ U_{22} \\ U_{33} \\ U_{21} \\ U_{31} \\ U_{32} \end{bmatrix}. \tag{10}$$

Substitute $\mathbf{g}$ and $\mathbf{u}$ into the simplified Einstein equation (7) to get the vector Einstein equation:

$$\mathbf{g} = \mathbf{u}. \tag{11}$$

IV. SOLVE GENERAL RELATIVITY FOR THE TIME DERIVATIVES

The linearity of general relativity in $\mathbf{d}$ means that $\mathbf{g}$ and $\mathbf{u}$ can be written as linear equations in $\mathbf{d}$:

$$\mathbf{g} = \mathbf{M}\mathbf{d} + \mathbf{m} \tag{12}$$

$$\mathbf{u} = \mathbf{N}\mathbf{d} + \mathbf{n}, \tag{13}$$

where $\mathbf{M}$ and $\mathbf{N}$ are 10x10 matrices, and $\mathbf{m}$ and $\mathbf{n}$ are 10-vectors. Plug these expressions for $\mathbf{g}$ and $\mathbf{u}$ into the vector Einstein equation (11) to get:

$$\mathbf{M}\mathbf{d} + \mathbf{m} = \mathbf{N}\mathbf{d} + \mathbf{n}. \tag{14}$$

Use ordinary linear algebra to solve for $\mathbf{d}$ to get:

$$\mathbf{d} = (\mathbf{M} - \mathbf{N})^{-1}(\mathbf{n} - \mathbf{m}). \tag{15}$$

Let $\mathbf{i}$ be the vector of interaction terms on the right side:

$$\mathbf{i} = (\mathbf{M} - \mathbf{N})^{-1}(\mathbf{n} - \mathbf{m}). \tag{16}$$

Substitute $\mathbf{i}$ into (15) to get the solved Einstein equation:

$$\mathbf{d} = \mathbf{i}. \tag{17}$$

V. UNPACK 10-VECTORS INTO SYMMETRIC 4X4 MATRICES

Unpack the 10-vectors of derivatives $\mathbf{d}$ and interaction terms $\mathbf{i}$ into symmetric 4x4 matrices $\mathbf{D}$ and $\mathbf{I}$, then relabel the elements and write them in block matrix form:

$$\mathbf{D} = \begin{bmatrix} \partial_0 g_{00} & & & \\ \partial_0 g_{10} & \partial^2_{00} g_{11} & & \\ \partial_0 g_{20} & \partial^2_{00} g_{21} & \partial^2_{00} g_{22} & \\ \partial_0 g_{30} & \partial^2_{00} g_{31} & \partial^2_{00} g_{32} & \partial^2_{00} g_{33} \end{bmatrix} \tag{18}$$

$$= \begin{bmatrix} \partial_0 g & & & \\ \partial_0 w_1 & \partial^2_{00} S_{11} & & \\ \partial_0 w_2 & \partial^2_{00} S_{21} & \partial^2_{00} S_{22} & \\ \partial_0 w_3 & \partial^2_{00} S_{31} & \partial^2_{00} S_{32} & \partial^2_{00} S_{33} \end{bmatrix} \tag{19}$$

$$= \begin{bmatrix} \partial_0 g & \\ \partial_0 \mathbf{w} & \partial^2_{00} \mathbf{S} \end{bmatrix}, \tag{20}$$

$$\mathbf{I} = \begin{bmatrix} \mathbf{i}_0 & & & \\ \mathbf{i}_1 & \mathbf{i}_4 & & \\ \mathbf{i}_2 & \mathbf{i}_7 & \mathbf{i}_5 & \\ \mathbf{i}_3 & \mathbf{i}_8 & \mathbf{i}_9 & \mathbf{i}_6 \end{bmatrix} = \begin{bmatrix} g_{\mathbf{i}} & & & \\ w_{\mathbf{i}_1} & S_{\mathbf{i}_{11}} & & \\ w_{\mathbf{i}_2} & S_{\mathbf{i}_{21}} & S_{\mathbf{i}_{22}} & \\ w_{\mathbf{i}_3} & S_{\mathbf{i}_{31}} & S_{\mathbf{i}_{32}} & S_{\mathbf{i}_{33}} \end{bmatrix} \tag{21}$$

$$= \begin{bmatrix} g_{\mathbf{i}} & \\ \mathbf{w}_{\mathbf{i}} & \mathbf{S}_{\mathbf{i}} \end{bmatrix}. \tag{22}$$

Equate corresponding blocks in $\mathbf{D}$ and $\mathbf{I}$ to get the unpacked equations:

$$\partial_0 g = g_{\mathbf{i}}, \tag{23}$$

$$\partial_0 \mathbf{w} = \mathbf{w}_{\mathbf{i}}, \tag{24}$$

$$\partial^2_{00} \mathbf{S} = \mathbf{S}_{\mathbf{i}}. \tag{25}$$

VI. SET THE COORDINATE SYSTEM TO ABSOLUTE SPACE AND TIME

Einstein's equation is valid in any coordinate system, so set the coordinate system to absolute space and time:

$$x^\delta = \begin{bmatrix} ct \\ x \\ y \\ z \end{bmatrix}. \tag{26}$$

In absolute space and time the coordinates do not vary with respect to each other:

$$\frac{dx^\gamma}{dx^\delta} = \begin{cases} 1, & \text{if } \gamma = \delta, \\ 0, & \text{if } \gamma \neq \delta. \end{cases} \tag{27}$$

1st partial derivatives become 1st total derivatives. To see this, use the standard formula for total derivatives and apply (27):

$$\frac{dg_{\sigma\omega}}{dx^\alpha} = \frac{\partial g_{\sigma\omega}}{\partial x^0}\frac{dx^0}{dx^\alpha} + \frac{\partial g_{\sigma\omega}}{\partial x^1}\frac{dx^1}{dx^\alpha} + \frac{\partial g_{\sigma\omega}}{\partial x^2}\frac{dx^2}{dx^\alpha} + \frac{\partial g_{\sigma\omega}}{\partial x^3}\frac{dx^3}{dx^\alpha} \\ = \frac{\partial g_{\sigma\omega}}{\partial x^\alpha}. \tag{28}$$

Similarly for 2nd derivatives:

$$\frac{d^2 g_{\sigma\omega}}{dx^\beta dx^\alpha} = \frac{d}{dx^\beta}\frac{dg_{\sigma\omega}}{dx^\alpha} = \frac{d}{dx^\beta}\frac{\partial g_{\sigma\omega}}{\partial x^\alpha} \\ = \frac{\partial^2 g_{\sigma\omega}}{\partial x^0 \partial x^\alpha}\frac{dx^0}{dx^\beta} + \frac{\partial^2 g_{\sigma\omega}}{\partial x^1 \partial x^\alpha}\frac{dx^1}{dx^\beta} \\ + \frac{\partial^2 g_{\sigma\omega}}{\partial x^2 \partial x^\alpha}\frac{dx^2}{dx^\beta} + \frac{\partial^2 g_{\sigma\omega}}{\partial x^3 \partial x^\alpha}\frac{dx^3}{dx^\beta} \\ = \frac{\partial^2 g_{\sigma\omega}}{\partial x^\beta \partial x^\alpha}. \tag{29}$$

Substitute total derivatives for the partial derivatives in (23) – (25) (including those inside the interaction terms $g_{\mathbf{i}}$, $\mathbf{w}_{\mathbf{i}}$, and $\mathbf{S}_{\mathbf{i}}$), and substitute $x^0 = ct$ from (26), to convert the unpacked equations (23) – (25) into ordinary three-dimensional differential field equations, with time t as the independent variable:

$$\frac{1}{c}\frac{dg}{dt} = g_{\mathbf{i}}, \tag{30}$$

$$\frac{1}{c}\frac{d\mathbf{w}}{dt} = \mathbf{w}_{\mathbf{i}}, \tag{31}$$

$$\frac{1}{c^2}\frac{d^2\mathbf{S}}{dt^2} = \mathbf{S}_{\mathbf{i}}. \tag{32}$$

VII. DISCUSSION

The field equations (30) – (32) are the fundamental equations of AQG. They exactly embed general relativity into absolute space and time. They reduce general relativity from the tensor mathematics of curved spacetime to the scalar/vector/matrix mathematics of classical mechanics.

The field equations (30) – (32) generate three new kinds of gravitons: scalar g gravitons, vector $\mathbf{w}$ gravitons, and matrix $\mathbf{S}$ gravitons[14]. g, $\mathbf{w}$, and $\mathbf{S}$ stand for *g*ravitational, **w**eak, and **S**trong. The equations for the g and $\mathbf{w}$ gravitons go as d/dt, so they are diffusive or Schrödinger like. The equation for the $\mathbf{S}$ gravitons goes as d^2/dt^2, so they are wavelike or Klein-Gordon like.

The three new kinds of gravitons appear as a natural consequence of exactly embedding general relativity into absolute space and time. Unconstrained general relativity uses curved spacetime to transmit gravity. Constrained to absolute space and time, the three new kinds of gravitons mathematically pop into existence to transmit gravity.

Exactly embedding general relativity into absolute space and time also makes it straightforward to quantize space and time. Both can be quantized by using fixed step sizes. Natural choices for the space and time steps would be the Planck distance and the Planck time. Quantized space and time make it possible to simulate our universe[12, 15].

Much of the complexity of the field equations is hidden inside $\mathbf{M}$, $\mathbf{m}$, $\mathbf{N}$, and $\mathbf{n}$ from equations (12) and (13), and consequently in the interaction terms $g_{\mathbf{i}}$, $\mathbf{w}_{\mathbf{i}}$, and $\mathbf{S}_{\mathbf{i}}$. For example, all of electromagnetism is in the interaction terms. By reducing general relativity to classical mechanics, we can now use established quantization machinery from classical mechanics (e.g. separation of variables) to further quantize the field equations (30) – (32), including the interaction terms. Other papers to appear will discuss this further.

The field equations (30) – (32) are mathematically the same as Einstein's original equation (4) in the sense that you can exactly reverse the steps from (4) to (30) – (32), to get exactly back to (4) again.

However, Einstein's equation and the field equations have different transformation properties. Einstein's equation is generally covariant, which means it appears the same in all coordinate systems. Using tensor mathematics enforces general covariance.

The disadvantage of general covariance is that if quantum gravity can be written as a tensor equation, it implies that gravity can be quantized in all coordinate systems. If in reality gravity can be quantized in only a finite number of coordinate systems, that may mean that expressing quantum gravity in a generally covariant way is impossible.

The field equations are not generally covariant. They have the forms (30) – (32) only in absolute space and time. But that is acceptable for two reasons: (1) absolute space and time may be the only coordinate system (within isomorphism) where it is possible to quantize general relativity, and (2) we live in only one universe, so we need only one coordinate system.

The field equations (30) – (32) have applications beyond AQG. For example, they can simulate classical general relativity on a fixed 3D grid with fixed time steps:

at each time step use a difference equation version of the field equations to update $g_{\alpha\beta}$ at each point on the grid, then use the force equation[7, 8], which corresponds to the geodesic equation, to update the positions of any particles involved.

AQG has many consequences relating to dark matter, dark energy, classical quantum mechanics, entanglement, particle physics, black holes, cosmology, etc. For overviews, see [9, 10, 12, 13].

VIII. EXPERIMENTAL EVIDENCE

AQG explains the weak force by positing that our universe is inside an enormous, ancient, extremal Kerr black hole[9, 11]. The angular momentum vector of the black hole can be identified as the axial vector responsible for the weak force.

One signature of AQG would therefore be a variation in the weak force related to local angular momentum, because local angular momentum can presumably modulate the angular momentum of the black hole. For example, a laboratory fixed on Earth might be able to see a daily variation in radioactive decay or parity violation as the Earth rotates.

It is currently difficult to establish either the nature or magnitude of the variation. One reason why is because there are too many dependencies on unknown quantities. For example, there are dependencies on the position and orientation of the Earth inside the black hole. Another reason why is that calculations in AQG are not yet advanced enough.

However, any variation at all would be both a signature of AQG and a violation of the standard model because electroweak theory does not predict a long range coupling of the weak force to local angular momentum.

This signature of AQG may have already been detected. He, et al.[5, 6] measured radioactive decay rates as the Earth rotated. They also measured radioactive decay rates in a centrifuge. They found that the decay rates were correlated with the rotation. Ding, et al.[1–3] performed their own experiments which initially were thought to falsify He, et al., but a reanalysis of their data confirmed He, et al.[6].

The results of He, et al., and Ding, et al., are encouraging. However, more experiments and more detailed calculations are needed.

[1] Ding, Y.Q., Sun, H.Q., Yang, Z.H., Liang, X.H., Wang, X.R., Zhang S.D., Cui, A.Z., "Can the decay rate of ^{32}P be changed by mechanic motion?", Sci China Ser B; Chem (Chinese Version), 2008, 38(11): 1035-1037, cited in https://doi.org/10.1007/s11426-009-0025-z
[2] Ding, Y.Q., Sun, H.Q., Yang, Z.H., Liang, X.H., Wang, X.R., Zhang S.D., Cui, A.Z., "Experimental test in effect of mechanic motion on P-32 half life", Chapter of Nnuclear Chemistry and Radiochemistry of the Chinese Nucear Society, Abtract of 8th seminar on nuclear chemistry and radiochemistry (Urumqi, Xinjiang), August 2007, 36-37, cited in https://doi.org/10.1007/s11426-009-0025-z
[3] Ding, Y.Q., Sun, H.Q., Yang, Z.H., Liang, X.H., Wang, X.R., Zhang S.D., Cui, A.Z., "Can the decay rate of ^{32}P be changed by mechanic motion?", Sci China Ser B: Chem, 2009, 52(5): 690-692, cited in https://doi.org/10.1007/s11426-009-0025-z
[4] Hartle, J.B., *Gravity: An Introduction to Einstein's General Relativity*, 2021, pg 483, eq (22.51) ff, https://www.cambridge.org/9781316517543
[5] He, Y., Qi, F., Qi, S.C., "The circadian rhythms in radioactive decay", The 40th IUPAC Congress Abstracts (Beijing), 2005, 212, cited in https://doi.org/10.1007/s11426-009-0025-z
[6] He, Y., Zeng, L., Qi, S., "Discussions about whether radioactive half life can be changed by mechanic motion", Sci. China Ser. B-Chem, 52, 693-698 (2009), https://doi.org/10.1007/s11426-009-0025-z
[7] Parker, D.B., "General Relativity in Absolute Space and Absolute Time", preprint, 2022-09-02, https://pgu.org/generalrelativityinabsolutespaceandtime_v2.pdf
[8] Parker, D.B., "General Relativity with Electromagnetism in Absolute Space and Time", preprint, 2023-05-22, https://pgu.org/electrogravity_v5.pdf
[9] Parker, D.B., "Parity violation is evidence that our universe is inside an extremal Kerr black hole (plus QEG)", poster, 2024-03-24, https://pgu.org/davidparker20240324.pdf
[10] Parker, D.B., "The holoverse", talk, 2024-04-01, https://pgu.org/theholoverse.pdf
[11] Parker, D.B., "Parity violation is evidence that our universe is inside an extremal Kerr black hole", preprint, 2024-04-01, https://pgu.org/parity_v1.pdf
[12] Parker, D.B., "Latest results from quantum electrogravity (QEG)", poster, 2025-03-12, https://pgu.org/poster2025.pdf
[13] Parker, D.B., "The speed of gravitons in two-slit diffraction", talk, 2025-03-16, https://pgu.org/talk2025.pdf
[14] Parker, D.B., "How to derive the field equations for three new kinds of gravitons", preprint, 2025-03-21, https://pgu.org/gravitons_v6.pdf
[15] Parker, D.B., "Our universe can be simulated", short response, 2025-11-02, https://pgu.org/simulation_v1.pdf
[16] Parker, D.B., "Absolute quantum gravity (AQG), including quantized space and time", supplemental Maxima file, 2026-02-18, https://pgu.org/absolutequantumgravity_v1.mac