Latest results from quantum electrogravity (QEG)

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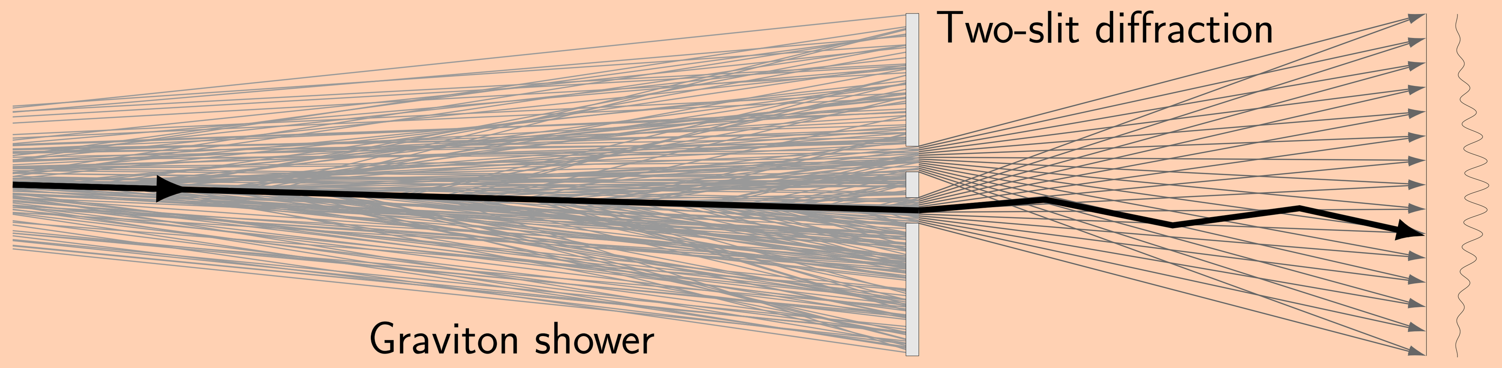
APS Global Physics Summit, March 16-21, 2025

Single-particle two-slit diffraction: graviton showers

Feynman said that single-particle two-slit diffraction is "a phenomenon which is impossible, *absolutely* impossible, to explain in any classical way, and which has in it the heart of quantum mechanics. In reality it contains the *only* mystery."[2]

In order to build up an interference pattern, quantum mechanics requires the single particle to mysteriously go through both of the two slits, not just one slit.

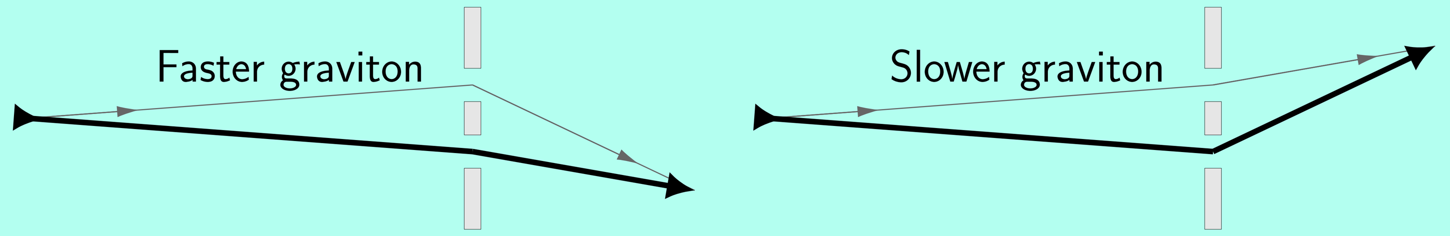
Quantum electrogravity (QEG) solves the mystery. In QEG, the particle does go through just one slit. The particle causes a graviton shower, the gravitons go through both slits while the particle goes through one slit, and reference frame interference ensues.



Two-slit diffraction is a quantum gravitational effect.

Single-particle two-slit diffraction: not Lorentz invariant

To ensure interference, the shower gravitons must have a range of speeds. Some of the gravitons must move faster than the particle, and some of the gravitons must move slower.



If the particle is a photon, then some of the gravitons must move faster than the photon. But nothing can move faster than photons in Lorentz invariant theories, so Lorentz invariant theories are inadequate to explain two-slit diffraction.

QEG is not Lorentz invariant. Also, QEG supplies the necessary gravitons.

Introduction to quantum electrogravity (QEG)

Overview: Quantum electrogravity (QEG) is a theory that unites quantum mechanics with Einstein's general relativity and Maxwell's electromagnetism, in Newton's absolute space and time. QEG uncurves space and time, resulting in three new kinds of gravitons: a scalar g graviton, a vector $\mathbf{w}$ graviton, and a matrix $\mathbf{S}$ graviton. g, $\mathbf{w}$, and $\mathbf{S}$ stand for **g**ravitational, **w**eak, and **S**trong.

Scope: QEG quantizes gravity, space, and time. The field equations for the QEG gravitons are derived directly from general relativity. QEG explains previously inexplicable quantum phenomena. QEG explains dark matter. QEG supports a cosmological model – the holoverse[1] – that explains parity violation and antimatter asymmetry. Current active research indicates that QEG can explain the periodic table of the particles in terms of bound gravitons.

Mechanics: In QEG, time is universal. Two events are simultaneous if they occur at the same absolute time. Every elementary particle has a precise three dimensional location in absolute space. Every elementary particle has a precise three dimensional velocity. Everything is particles. There is no wave/particle duality. There is no uncertainty principle. QEG is neither Lorentz invariant nor generally covariant.

I think that QEG is the Grand Unified Theory.

The field equations for the g, $\mathbf{w}$, and $\mathbf{S}$ gravitons

The field equations for the g, $\mathbf{w}$, and $\mathbf{S}$ gravitons are:

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

where g_{mint}, $\mathbf{w}_{\text{mint}}$, and $\mathbf{S}_{\text{mint}}$ represent the mass/interaction terms, and the fields g, $\mathbf{w}$, and $\mathbf{S}$ correspond to blocks of the symmetric metric tensor $g_{\mu\nu}$:

$$g_{\mu\nu} = \begin{bmatrix} g_{00} & g_{10} & g_{20} & g_{30} \\ g_{10} & g_{11} & g_{21} & g_{31} \\ g_{20} & g_{21} & g_{22} & g_{32} \\ g_{30} & g_{31} & g_{32} & g_{33} \end{bmatrix} = \begin{bmatrix} g & w_1 & w_2 & w_3 \\ w_1 & S_{11} & S_{21} & S_{31} \\ w_2 & S_{21} & S_{22} & S_{32} \\ w_3 & S_{31} & S_{32} & S_{33} \end{bmatrix} = \begin{bmatrix} g & \mathbf{w}^\mathsf{T} \\ \mathbf{w} & \mathbf{S} \end{bmatrix}. \tag{2}$$

The field equations (1) are are ordinary differential equations; they use total derivatives and not partial derivatives. The g and $\mathbf{w}$ fields go as d/dt, so they are diffusive or Schrödinger-like. The $\mathbf{S}$ field goes as d^2/dt^2, so it is wavelike or Klein-Gordon-like.

Gravity waves: S gravitons in vacuo

In photon two-slit diffraction, some of the shower gravitons go faster than the photon, and some go slower. However, experiments have measured that gravity waves propagate almost exactly at photon speed, not faster, and not slower.

The reason for the apparent discrepancy is that in vacuo, the field equations (1) become singular. The equation of motion for the $\mathbf{S}$ gravitons degenerates to become the same as the equation of motion for photons, so that the $\mathbf{S}$ gravitons propagate at photon speed. Experiments that measure gravity waves are measuring $\mathbf{S}$ gravitons traveling in vacuo.

The three generations, bound gravitons, and particle decay

There are three generations of neutrinos, leptons, and quarks. It is an open question as to why.

It leaps to the eye that the three kinds of gravitons in QEG can answer the question about the three generations. One possibility (there are several) is that each of the three generations involves a different kind of graviton. For example, an electron neutrino could be a g graviton bound to an uncharged electron. That may or may not be correct because this is active research.

In QEG, all of the particles that can decay have at least one bound graviton. It is also looking increasingly likely that all of the non-graviton particles, even if they can't decay, have at least one bound graviton.

There are at least two ways that the gravitons might be bound: shell binding or point binding. If muons, for example, are actually point-like particles, then any bound gravitons must be point bound.

By adding bound gravitons to lower energy states, it appears to be eminently possible to build a periodic table of the particles.

Dark matter: graviton gas

In QEG, dark matter is graviton gas. Atmospheres of graviton gas form around gravitating matter. Your body, and the room you are in, is filled with graviton gas.

Graviton atmospheres are similar to ordinary molecular atmospheres. The terminal velocity of a ping-pong ball in a closed room is the same in every direction, as measured by electromagnetic clocks. Similarly, the terminal velocity of photons in an inertial reference frame is the same in every direction, as measured by electromagnetic clocks.

Stationary distributions of gravitons define reference frames.

Entanglement, simulation, and the quantization of space and time

Spin is quantized, so particles must be entangled in order to conserve angular momentum. If space and time are quantized, then particles must also be entangled in order to conserve momentum.

Perhaps the best way to describe how entanglement works in QEG is to show how to implement it in a simulation. Using C or C++ as the programming language, a particle in QEG can be described by a memory structure as:

```
struct ParticleStruct
{ CoordinateType Position[3];
  SpeedType Velocity[3]; // or Speed and Direction[3].
  ParticleStruct* EntangledParticleListPointer;
  // ... followed by other per-particle data.
};
```

The `ParticleStruct*` is a pointer from one particle to the next particle on a circular list of entangled particles. When an interaction occurs which fixes the spin or momentum on one particle, that particle can immediately adjust the spins or momentums for the other particles on the circular list, and then remove itself from the list.

`CoordinateType` and `SpeedType` are the scalar data types for each of the three components of the particle's `Position` and `Velocity`. In a typical simulation both `CoordinateType` and `SpeedType` might be set to double precision floating point. To quantize space, change the types to integer (e.g. fixed point) types. `Time` is a global variable that can be quantized in the same way.

At full Planck resolution, 256 bits of integer precision is enough to simulate a region of the holoverse[1] that is about 10^{15} times the diameter of our observable universe, for a period of about 10^{26} years.

One reason why it is easier to quantize gravity, space, and time in QEG than in general relativity (if it is even possible at all) is because of equation (20). In general relativity, small changes in one coordinate can cause even smaller changes in another coordinate, which then might require an increase in precision to prevent information loss. In QEG, the coordinates are independent so precision never needs to change.

The uncertainty principle and scattering probabilities

In QEG, uncertainty is not a principle, it is a physical consequence.

In quantum mechanics, the interference pattern from two-slit diffraction is smeared due to uncertainty in the positions and momentums of the incoming particles. In QEG the particles have precise positions and momentums; the interference pattern is smeared due to variations in the number, speeds, and trajectories of the shower gravitons.

Because positions and momentums in QEG are precise, scattering has to be probabilistic because two particles with precise positions are unlikely to ever be at the same exact position at the same exact time. At a given time, two particles are more likely to scatter if they are closer together, among other factors.

How to derive the field equations for the g, $\mathbf{w}$, and $\mathbf{S}$ gravitons

To derive the graviton field equations (1), start from the Einstein equation for general relativity:

$$G_{\alpha\beta} = (8\pi K/c^4)\,T_{\alpha\beta}. \tag{3}$$

Simplify notation by letting $U_{\alpha\beta} = (8\pi K/c^4)\,T_{\alpha\beta}$, so that (3) becomes:

$$G_{\alpha\beta} = U_{\alpha\beta}. \tag{4}$$

Let x^0 be the time coordinate. The highest-order independent pure (HIP) time derivatives in the Einstein tensor $G_{\alpha\beta}$ are the 10 partial derivatives:

$$\partial_0 g_{00},\ \partial_0 g_{10},\ \partial_0 g_{20},\ \partial_0 g_{30},\ \partial^2_{00} g_{11},\ \partial^2_{00} g_{22},\ \partial^2_{00} g_{33},\ \partial^2_{00} g_{21},\ \partial^2_{00} g_{31},\ \partial^2_{00} g_{32}. \tag{5}$$

Proving (5) takes more math than fits here, so refer to Theorem 1 in [3]. $G_{\alpha\beta}$ and $U_{\alpha\beta}$ are 4x4 matrices with 16 elements, but because they are symmetric there are only 10 independent elements. Pack the 10 HIP derivatives (5) and the 10 corresponding elements of $G_{\alpha\beta}$ and $U_{\alpha\beta}$ into 10-vectors $\mathbf{d}$, $\mathbf{g}$, and $\mathbf{u}$:

$$\mathbf{d} = \begin{bmatrix} \partial_0 g_{00} & \partial_0 g_{10} & \partial_0 g_{20} & \partial_0 g_{30} & \partial^2_{00} g_{11} & \partial^2_{00} g_{22} & \partial^2_{00} g_{33} & \partial^2_{00} g_{21} & \partial^2_{00} g_{31} & \partial^2_{00} g_{32} \end{bmatrix}^\mathsf{T}, \tag{6}$$

$$\mathbf{g} = \begin{bmatrix} G_{00} & G_{10} & G_{20} & G_{30} & G_{11} & G_{22} & G_{33} & G_{21} & G_{31} & G_{32} \end{bmatrix}^\mathsf{T}, \tag{7}$$

$$\mathbf{u} = \begin{bmatrix} U_{00} & U_{10} & U_{20} & U_{30} & U_{11} & U_{22} & U_{33} & U_{21} & U_{31} & U_{32} \end{bmatrix}^\mathsf{T}. \tag{8}$$

Substitute (7) and (8) into the simplified Einstein equation (4), to get the 10-vector Einstein equation:

$$\mathbf{g} = \mathbf{u}. \tag{9}$$

$\mathbf{g}$ is linear in $\mathbf{d}$, but the proof takes more math than fits here, so refer to Theorem 2 in [3]. To maximize the generality of this derivation, allow that $\mathbf{u}$ is also linear in $\mathbf{d}$ and has the same HIP time derivatives. From the linearity of $\mathbf{g}$ and $\mathbf{u}$ in $\mathbf{d}$, we can write $\mathbf{g}$ and $\mathbf{u}$ as

$$\mathbf{g} = \mathbf{M}\mathbf{d} + \mathbf{m}, \tag{10}$$

$$\mathbf{u} = \mathbf{N}\mathbf{d} + \mathbf{n}, \tag{11}$$

where $\mathbf{M}$ and $\mathbf{N}$ are 10×10 matrices, and $\mathbf{m}$ and $\mathbf{n}$ are 10-vectors. Plug (10) and (11) into (9):

$$\mathbf{M}\mathbf{d} + \mathbf{m} = \mathbf{N}\mathbf{d} + \mathbf{n}. \tag{12}$$

Solve for $\mathbf{d}$:

$$\mathbf{d} = (\mathbf{M} - \mathbf{N})^{-1}(\mathbf{n} - \mathbf{m}). \tag{13}$$

Let $\mathbf{i}_{\text{mint}}$ be the 10-vector of mass/interaction terms on the right hand side of (13):

$$\mathbf{i}_{\text{mint}} = (\mathbf{M} - \mathbf{N})^{-1}(\mathbf{n} - \mathbf{m}). \tag{14}$$

The solved Einstein equation (13) becomes

$$\mathbf{d} = \mathbf{i}_{\text{mint}}. \tag{15}$$

Unpack the 10-vectors $\mathbf{d}$ (6) and $\mathbf{i}_{\text{mint}}$ (14) into symmetric 4×4 matrices $\mathbf{D}$ and $\mathbf{I}_{\text{mint}}$, then rename the elements to put them into block matrix form:

$$\mathbf{D} = \begin{bmatrix} \partial_0 g_{00} & \partial_0 g_{10} & \partial_0 g_{20} & \partial_0 g_{30} \\ \partial_0 g_{10} & \partial^2_{00} g_{11} & \partial^2_{00} g_{21} & \partial^2_{00} g_{31} \\ \partial_0 g_{20} & \partial^2_{00} g_{21} & \partial^2_{00} g_{22} & \partial^2_{00} g_{32} \\ \partial_0 g_{30} & \partial^2_{00} g_{31} & \partial^2_{00} g_{32} & \partial^2_{00} g_{33} \end{bmatrix} = \begin{bmatrix} \partial_0 g & \partial_0 w_1 & \partial_0 w_2 & \partial_0 w_3 \\ \partial_0 w_1 & \partial^2_{00} S_{11} & \partial^2_{00} S_{21} & \partial^2_{00} S_{31} \\ \partial_0 w_2 & \partial^2_{00} S_{21} & \partial^2_{00} S_{22} & \partial^2_{00} S_{32} \\ \partial_0 w_3 & \partial^2_{00} S_{31} & \partial^2_{00} S_{32} & \partial^2_{00} S_{33} \end{bmatrix} = \begin{bmatrix} \partial_0 g & \partial_0 \mathbf{w}^\mathsf{T} \\ \partial_0 \mathbf{w} & \partial^2_{00} \mathbf{S} \end{bmatrix}, \tag{16}$$

$$\mathbf{I}_{\text{mint}} = \begin{bmatrix} \mathbf{i}_{0_{\text{mint}}} & \mathbf{i}_{1_{\text{mint}}} & \mathbf{i}_{2_{\text{mint}}} & \mathbf{i}_{3_{\text{mint}}} \\ \mathbf{i}_{1_{\text{mint}}} & \mathbf{i}_{4_{\text{mint}}} & \mathbf{i}_{7_{\text{mint}}} & \mathbf{i}_{8_{\text{mint}}} \\ \mathbf{i}_{2_{\text{mint}}} & \mathbf{i}_{7_{\text{mint}}} & \mathbf{i}_{5_{\text{mint}}} & \mathbf{i}_{9_{\text{mint}}} \\ \mathbf{i}_{3_{\text{mint}}} & \mathbf{i}_{8_{\text{mint}}} & \mathbf{i}_{9_{\text{mint}}} & \mathbf{i}_{6_{\text{mint}}} \end{bmatrix} = \begin{bmatrix} g_{\text{mint}} & w_{1_{\text{mint}}} & w_{2_{\text{mint}}} & w_{3_{\text{mint}}} \\ w_{1_{\text{mint}}} & S_{11_{\text{mint}}} & S_{21_{\text{mint}}} & S_{31_{\text{mint}}} \\ w_{2_{\text{mint}}} & S_{21_{\text{mint}}} & S_{22_{\text{mint}}} & S_{32_{\text{mint}}} \\ w_{3_{\text{mint}}} & S_{31_{\text{mint}}} & S_{32_{\text{mint}}} & S_{33_{\text{mint}}} \end{bmatrix} = \begin{bmatrix} g_{\text{mint}} & \mathbf{w}^\mathsf{T}_{\text{mint}} \\ \mathbf{w}_{\text{mint}} & \mathbf{S}_{\text{mint}} \end{bmatrix}. \tag{17}$$

Equate corresponding blocks in (16) and (17) to get the unpacked Einstein equations:

$$\partial_0 g = g_{\text{mint}}, \qquad \partial_0 \mathbf{w} = \mathbf{w}_{\text{mint}}, \qquad \partial^2_{00} \mathbf{S} = \mathbf{S}_{\text{mint}}. \tag{18}$$

Convert the partial derivatives in (18) (and the partial derivatives implicit in g_{mint}, $\mathbf{w}_{\text{mint}}$, and $\mathbf{S}_{\text{mint}}$) into total derivatives. To do that, set the coordinate system to absolute space and time:

$$x^\delta = [ct, x, y, z]^\mathsf{T}. \tag{19}$$

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

$$\frac{dx^\gamma}{dx^\delta} = \begin{cases} 1, & \text{if } \gamma = \delta, \\ 0, & \text{if } \gamma \neq \delta. \end{cases} \tag{20}$$

1st partial derivatives become 1st total derivatives. To see this, use the standard formula for total derivatives and apply (20):

$$\frac{dg_{\mu\nu}}{dx^\alpha} = \frac{\partial g_{\mu\nu}}{\partial x^0}\frac{dx^0}{dx^\alpha} + \frac{\partial g_{\mu\nu}}{\partial x^1}\frac{dx^1}{dx^\alpha} + \frac{\partial g_{\mu\nu}}{\partial x^2}\frac{dx^2}{dx^\alpha} + \frac{\partial g_{\mu\nu}}{\partial x^3}\frac{dx^3}{dx^\alpha} = \frac{\partial g_{\mu\nu}}{\partial x^\alpha}. \tag{21}$$

Similarly for 2nd derivatives. Substitute total derivatives for the partial derivatives in (18), and substitute $x^0 = ct$ from (19), to convert the unpacked Einstein equations (18) into the ordinary differential field equations for the three new gravitons (1):

$$\frac{1}{c}\frac{dg}{dt} = g_{\text{mint}}, \qquad \frac{1}{c}\frac{d\mathbf{w}}{dt} = \mathbf{w}_{\text{mint}}, \qquad \frac{1}{c^2}\frac{d^2\mathbf{S}}{dt^2} = \mathbf{S}_{\text{mint}}. \tag{22}$$

References

[1] "Parity violation is evidence that our universe is inside an extremal Kerr black hole (plus QEG)", 2024, pgu.org. [2] Vol III, pg 1-1. [3] "How to derive the field equations for three new kinds of gravitons", 2025, pgu.org.