Newtonian wave mechanics of quantum gravity, spin, and electromagnetism
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Sometime in the spring or early summer of 1997, while mulling over the lack of a theoretical understanding which had been preventing a unification in the modeling of the two academic fields of gravitational and quantum phenomena, I formulated a simple thought experiment.

Place the two most massive rest mass particles of condensed matter, the neutron, together in contact and compute the gravitational force operating between the two particles. The particle mass, in this case the rest mass of the neutron, m_0, along with its reputed wave-particle size, the reduced Compton or angular wavelength, r_0, using the empirically derived gravitational constant, G, were plugged into Newton's gravitational law as shown here to compute the force operating between the two bodies of mass, in this case, from the conjectured surface of the particles to their centers of gravity. In the following, those two bodies, M_a, are expressed in terms of the number of units of the neutron, n_{Ma}, and in the distance of separation, in terms of the number of units of the angular wavelength, n_{r0}. The neutron is used with the understanding that the mass of the proton and electron together are closely equivalent to that of the neutron, and from one perspective are a function of the neutron through beta decay. In this thought experiment, these numbers are all reduced to 1, giving us the final phrase, as

$$F = \frac{M_1 \cdot M_2}{d^2} G = \frac{n_{M1} m_0 \cdot n_{M2} m_0}{(n_{r_0} r_0)^2} G = \frac{(n_{M1} n_{M2}) m_0^2}{(n_{r_0}^2) r_0^2} G = \frac{m_0^2}{r_0^2} G \tag{1.1}$$

Apparently, this had not been done or recorded as having been done before.

It was obvious to me that gravitational and individual particle interactions were already unified. If this was not the case, we would not see small aggregates of matter fall toward the earth and a presumed center of gravity. But it does this in keeping with Newton's law of gravity, and for that matter, in keeping with general relativity, both of which use G as a universal invariant in gauging the gravitational interaction. It does this without apparent further analysis of G beyond providing the necessary dimensional structure required to characterize the solution as a force. Since celestial bodies are observed to exhibit that gravitational attraction, it is reasonable to assume that there must be an existing mechanism that unites particles with observed properties of mass. In modeling Newtonian gravity, space and time are treated as separate dimensional properties, with space treated as a true vacuum or a field filled with a wave bearing substrate, such as an aether. In the case of a vacuum, it is currently assumed that a messenger particle, the graviton—yet to be detected—mediates the interaction.

For general relativity, it is apparent that such massive particles as defined by quantum theory must couple with spacetime as defined by general relativity, again perhaps as the undetected graviton. But in this case, spacetime is treated as a four-dimensional space time manifold. General relativity famously describes gravity as a function of spacetime curvature in directing rest mass where to move in a curved gravitational field, with rest mass telling spacetime how to curve in response to its energy, thereby directing that motion in spacetime.

With respect to gravity caused by spacetime curvature, rest mass must first be present in order to curve an otherwise flat spacetime, which through the process of curving, directs the subsequent travel of rest mass as gravity. On the other hand, spacetime with an inherent flexibility must first be present before the inclusion of rest mass for there to be anything to curve.

Apparently, what is missing is a common definition of the terms used in the descriptions of both fields of study. In the context of the chicken and egg paradox, we must decide which comes first, which has primacy. Is it the universal egg producing quantum chickens or the universal chicken producing quantum eggs? Or perhaps a universal something else giving rise to both?

Gravity requires at least two separate particles for rest mass to interact. In general relativity, it does this across the spacetime manifold. For two particles in contact in GR, the intervening separation in the manifold shrinks to nothing, presumably with the rest mass particles constituted with some extended form. If we consider spacetime as having inertial properties and not as a massless manifold, then the most self-consistent way to model both spacetime and quanta is as a wave-bearing medium in creating quanta which interact back upon each other through the manifold, so that the interactive medium can be modeled as an inertial manifold itself.

With these thoughts in mind, we turn back to our thought experiment of 1997.

The result, in terms of Newtons, N, or kilogram-meter per second squared, as shown here was,

$$F_0 = \frac{m_{01} \cdot m_{02}}{r_0^2} G = \frac{1.675\ldots x10^{-27^2}}{2.100\ldots x10^{-16^2}} G = \frac{2.805\ldots x10^{-54}}{4.411\ldots x10^{-32}} G = 4.245\ x10^{-33}\ N \tag{1.2}$$

The close approximation of the solution to F and the value of r_0^2, with the understanding that it could represent a differential area of a fundamental particle, was immediately apparent. A quick calculation of the ratio of the area to the force gave a figure of 10.3906. After some analysis concerning what that figure might indicate, squaring gave a figure of 107.9643 which is very close to 108. Rounding to 108 or 36x3, and taking the square root, gave a value of $6\sqrt{3}$ or 10.3923. This factor has significance in the derivation of a gravitational differential quantum as a function of a change in energy-stress density over time as one of 6 components of the stress differential.

For comparison we also performed the same thought experiment using the valuations for the proton and got the related ratios of 10.47…109.7637, close to 10.3923, but not nearly as close as 10.3906.

$$F_p = \frac{m_p \cdot m_p}{r_p^2} G = \frac{1.673\ldots x10^{-27^2}}{2.103\ldots x10^{-16^2}} G = \frac{2.798\ldots x10^{-54}}{4.423\ldots x10^{-32}} G = 4.222\ x10^{-33} \tag{1.3}$$

Subsequent analysis allows us to invert the first two terms of (1.2) to derive Newton's gravitational constant in terms of a quantum unit of gravity as shown below in the last phrasing, where the differential force, $\tau_{0G} = d\tau_0$, is a function of a differential energy stress, dT_0.

$$G = \frac{r_0^2}{m_0^2} F_0 = \frac{r_0^2}{m_0^2} \tau_{0G}, \ \ where\ \tau_{0G} = d\tau_0 = \frac{\mathrm{A}_0}{6\sqrt{3}} dT_0 = 4.245\ x10^{-33}\ N \quad (1.4)$$

From this we can show a quantum expression of Newton's gravitational law as follows, where this is expressed in flat spacetime in those cases where the relativistic effects of spacetime curvature are negligible. This is seminal to understanding the Newtonian nature of quantum gravity.

$$F = \frac{M_1 \cdot M_2}{d^2} G = \frac{(n_{M1} n_{M2}) m_0^2}{(n_{r_0}^2) r_0^2} G = \frac{(n_{M1} n_{M2}) m_0^2}{(n_{r_0}^2) r_0^2} \left(\frac{r_0^2}{m_0^2} \tau_{0G} \right) = \frac{(n_{M1} n_{M2})}{(n_{r_0}^2)} \tau_{0G} \quad (1.5)$$

In subsequent elaboration of this insight, as I introduced an understanding of the Hubble rate to my reading of the phenomenal work of William C. Elmore and Mark A. Heald, authors of the Dover publication, Physics of Waves, in focusing on Chapter 1 - Transverse Waves on a String in the complex wave analysis of harmonic or sinusoidal waves and the reflection and transmission of waves at a discontinuity, Chapter 3 – Introduction to the Theory of Elasticity in torsion of round tubes and rods, and Chapter 7 – Elastic Waves in Solids in their formal treatment of stress and strain tensors, it became clear to me that the essential unifying insight of the simple thought experiment concerning the structural nature of Newton's gravitational constant could be expressed in a modeling of rest mass quanta. This was done not as probabilistic wave-particles of quantum field theory, but as emergent, classically derived, locally discretized, rotating torsional oscillations of an isotropic bulk under differential expansion stress, where these oscillations are recognized in the standard model as baryonic matter. From the unstable baryonic neutron, with beta decay and the emission of the electron and transformation to the stable proton, all subsequent quantum processes including the generation of photons can be modeled.

This standing wave model of rotational oscillation as a function of the Hubble rate, naturally has 18 emergent components in the resulting sustained, rotating stress and strain tensors. 12 of these comprise the operation of angular momentum of the localized transverse wave force, τ_0, that produce spin and the mechanical capacitive/inductive cycle that becomes the emergent electromagnetic field and 6 of them are invariantly centripetal as the symmetric components of a differential wave force, $d\tau_0$, that produces quantum gravity. The differential isotropic stress, dT_0, operating on this baryonic waveform, does so orthogonally to all instant components of this rotating double tensor as a fourth dimensionally directed vector modified by $\sqrt{3}$, so that the isotropic stress differential on the left and center below is essentially a differential with respect to time, shown with space indices at right,

$$dT_0 = 2\left(dT_{\mu\nu}\right) = \sqrt{3}\tau_{ij} \quad (1.6)$$

This isotropically centered double tensor can be represented by the following double matrix of the wave force shown here, expressed in an arbitrary cartesian orientation with respect to a unit cube. In previous depictions of this form, I have used a minus sign in joining the two matrices so that the total of the 18 components can be summed at any point in time. Here, I have used the add sign to indicate that it is a conservative system with all opposing components in balance.

$$\tau_{ij} = \begin{bmatrix} -d\tau_0 & \tau_0 \cos \omega t & \tau_0 \sin \omega t \\ -\tau_0 \cos \omega t & -d\tau_0 & \tau_0 \\ -\tau_0 \sin \omega t & -\tau_0 & -d\tau_0 \end{bmatrix} + \begin{bmatrix} d\tau_0 & -\tau_0 \cos \omega t & -\tau_0 \sin \omega t \\ \tau_0 \cos \omega t & d\tau_0 & -\tau_0 \\ \tau_0 \sin \omega t & \tau_0 & d\tau_0 \end{bmatrix} \qquad (1.7)$$

To finish with a full foundational solution of Newtonian quantum wave mechanics, using the same values for the neutron of m_0 and r_0 in a formulation of the wave force, where time, t_0, is the inverse angular frequency of the neutron, ω_0, based on a wave interpretation of mass-energy equivalence from Einstein's equation, $E = mc^2$, we have the force and stress equations

$$\tau_0 = \frac{m_0 \cdot r_0}{t_0^2} = \frac{1.675\ x10^{-27} \cdot 2.100\ x10^{-16}}{1.427\ x10^{24^{-2}}} = \frac{3.517\ x10^{-43}}{2.037\ x10^{48^{-1}}} = 7.167\ x10^5\ N \qquad (1.8)$$

$$T_0 = \frac{\tau_0}{r_0^2} = \frac{7.167 \ldots x10^5}{2.100 \ldots x10^{-16^2}} = \frac{7.167 \ldots x10^5}{4.411 \ldots x10^{-32}} = 1.625\ x10^{37}\ N/m^2 \qquad (1.9)$$

If we constrain the invariance in stress over time, we can rephrase this last form as a differential as shown, which by using the differential force as the gravitational quantum, (1.4), gives the covariant values of dr_0^2 as shown in the denominators of the middle terms below.

$$dT_0 = \frac{\partial \tau_0}{\partial r_0^2} = \frac{d\tau_0}{dr_0^2} = \frac{4.245 \ldots x10^{-33}}{2.616 \ldots x10^{-35^2}} = \frac{4.245 \ldots x10^{-33}}{2.612 \ldots x10^{-70}} = 1.625\ x10^{37}\ N/m^2 \qquad (1.10)$$

Here partial differentials are shown initially, but if they are covariant, we can stay with the standard forms as in the third term. In the first case, the value of dr_0 is the Planck length and the value of dr_0^2 is the Planck area, $d\mathrm{A}_0$. In this case, these values arise logically from the Newtonian wave mechanics without necessary recourse to general relativity or quantum mechanics.

$$dT_0 = \frac{d\tau_0}{d\mathrm{A}_0} = \frac{4.245 \ldots x10^{-33}}{2.612 \ldots x10^{-70}} = \frac{a\ gravitational\ quantum}{the\ Planck\ area} \qquad (1.11)$$

These valued functions as the inherent wave force of the matrices of (1.7) are shown operating across the horizontal facing surfaces of a unit cube in and through the horizontal plane with an X axis in the vertical orientation, Y to the left, and Z facing out of the page. The directional vectors as denominators indicate the unit surfaces of the referenced cube, and the numerators indicate the initial condition as wave force vectors at (1.7). The red components constitute quantum gravity, the blue components constitute quantum spin, the green components constitute oscillation in quantum capacitive/inductive moments as a quantum EM field. I have taken liberties with the indexing, as the columns represent force vectors, and the rows are areas, as with (1.7).

$$2\ [Stress\ tensor_{ij}] = \begin{bmatrix} {}^{-x}/_{x} & {}^{y}/_{x} & {}^{z}/_{x} \\ {}^{-x}/_{y} & {}^{-y}/_{y} & {}^{z}/_{y} \\ {}^{-x}/_{z} & {}^{-y}/_{z} & {}^{-z}/_{z} \end{bmatrix} + \begin{bmatrix} {}^{x}/_{-x} & {}^{-y}/_{-x} & {}^{-z}/_{-x} \\ {}^{x}/_{-y} & {}^{y}/_{-y} & {}^{-z}/_{-y} \\ {}^{x}/_{-z} & {}^{y}/_{-z} & {}^{z}/_{-z} \end{bmatrix} = \frac{Force_i}{Area_j} \qquad (1.12)$$

We note that the time free inertial invariant of this modeling, as evaluated as the dividend of the next to last term of (1.8), is tav, ת $= m_0 \cdot r_0 = m_q \cdot r_q$, where the subscript, q, is true for a fundamental quantum waveform, where $\hbar$ is Planck's reduced constant and c is the speed of light in a vacuum.

$$\text{ת} = m_q \cdot r_q = \hbar/c = 3.517\ x10^{-43}\ kg \cdot meters \tag{1.13}$$

The ratio of the last phrasing of (1.4) and (1.8) is

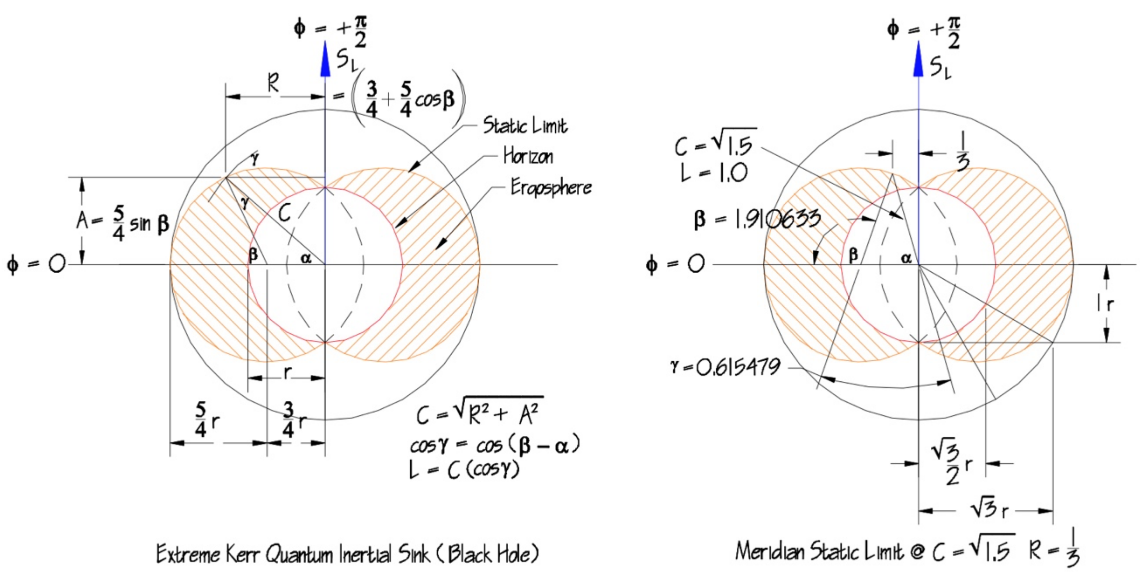
$$\frac{d\tau_0}{\tau_0} = \frac{4.245\ x10^{-33}}{7.167x10^{5}} = 5.922\ x10^{-39} \tag{1.14}$$

This ratio of the differential gravitational force in red and the spin and EM moments in blue and green respectively, generated as the wave force, is representative of the ratio of the gravitational force and the strong force observed in experimental data in the standard model.

This Newtonian wave representation of quantum phenomena can be given a general relativistic representation which is conformal. The field equation in flat spacetime is

$$T(\Lambda) = 2T_{\mu\nu} = g_{\mu\nu}\Lambda \tag{1.15}$$

where $T_{\mu\nu}$ is the same stress energy tensor as in the Newtonian model, and lambda is the cosmological constant, which in this case is the Hubble rate, and $g_{\mu\nu}$ is a quantum metric. As a solution to this field equation, we can define an extreme Kerr quantum metric, with a depiction of the ergosphere and quantum black hole as here,



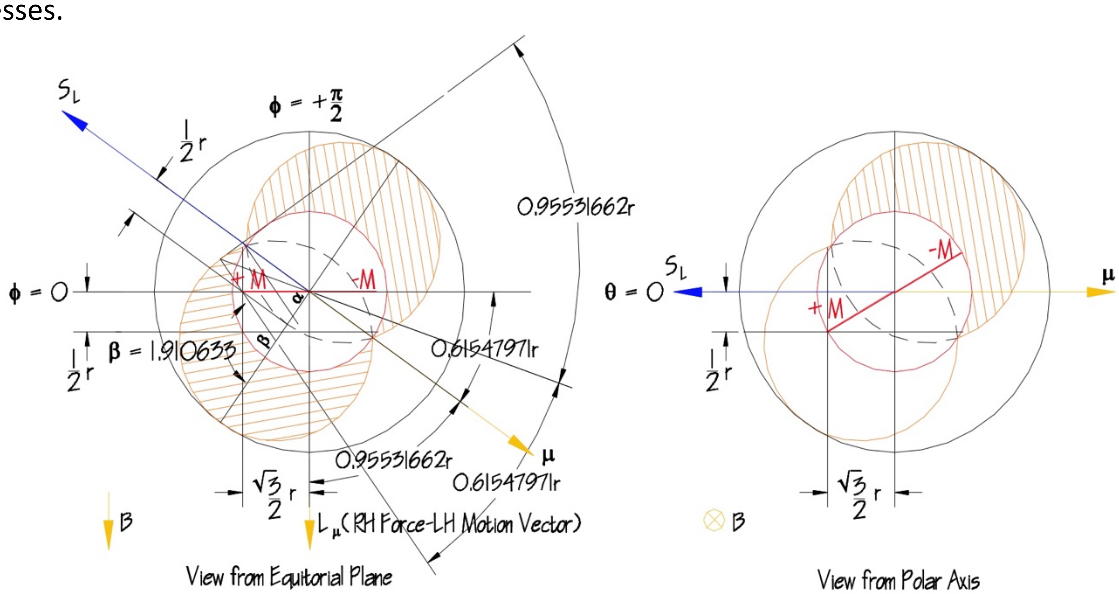
Quantum Inertial Sink 1

The volume of the ergosphere, the hatched region in this form subject to spacetime frame dragging or strain, is 19.88 r_0^3 versus the volume within the event horizon of 4.19 r_0^3. The ratio of the ergosphere to the quantum black hole is therefore 4.74 to 1. The ratio of dark matter to baryonic matter is stated online as approximately 5 to 1. The metrics of mass, m_0, and reduced wavelength, r_0, and the resulting wave values of τ_0 and $d\tau_0$ are defined on the surface of the event horizon as a spherical singularity, and it is these metrics that are involved in the computations of gravitational and electromagnetic interactions. The volume of the ergosphere, ideally defined as the region of wave strain or spacetime frame dragging starting with the static limit as a threshold of that strain, is effectively entrained with the black hole mass dynamics as defined by the metrics. The ergosphere, at 4.74 times the mass of the baryon itself, is close to the dark matter mass needed to account in those cases for otherwise anomalous galactic rotational dynamics. As such, density within the ergosphere is maintained while density outside the static limit decreases, presumably asymptotically.

With reference to Quantum Inertial Sink 2 Diagram, the time-like quantum metric is given as a modified chargeless extreme Kerr metric. The modification in the ϕ coordinates as shown here, accounts for transverse oscillation, where the quantum mass has been explicitly geometrized as r_{0n}. Full development of the metric can be found in my work elsewhere.

$$d\tau^2 = \left(1 - \frac{2r_{0n}}{r_{0n}}\right)dt^2 + \frac{4{r_{0n}}^2}{r_{0n}}dt\,d\theta - \frac{dr^2}{\left(1 - \frac{r_{0n}}{r_{0n}}\right)^2} - R^2 d\theta^2 \mp \left\{\left(e^{\pm i(\omega_0 t \mp \theta)} L\,d\phi\right)^2\right\} \tag{1.16}$$

In the presence of a magnetic field of sufficient strength as shown at B at the lower left of the diagram below, the inertial sink aligns with the inductive moment and the spin axial vector, S_L, precesses.



Quantum Inertial Sink 2