A Simple Newtonian Quantum Gravity Theory That Predicts the Same Light Bending as GR And also a New gravitational prediction that can be tested!

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Abstract

In this paper we propose a new and simple theory of quantum gravity, inspired by Newton, that gives the same prediction of light bending as Einstein's theory of general relativity. This new quantum gravity theory also predicts that non-light beams, that is to say beams of particles with rest-mass, such as electron beams, will only have half the bending of light as GR. In other words, this theory is testable. Based on this theory, we will suggest that it is a property of light that makes it bend twice as much as that amount of bending that is predicted by the Newtonian theory. This quantum gravity theory may also predict that the gravity force should be equal to the strong force when we are working at distances within the nucleus.

We are also suggesting a minor adjustment to the Newtonian gravitational acceleration field that renders that field always equal to the Planck acceleration at the Schwarzschild radius, and the same as predicted by Newton when we are dealing with weak gravitational fields. This stands in contrast to GR, which predicts an infinitely strong gravitational field at the Schwarzschild radius. It also stands in contrast to standard Newtonian theory, which predicts a very weak gravitational acceleration field at the Schwarzschild radius for super massive objects.

Key words: Quantum gravity, Newton gravitational constant, bending of light, bending of non-light, strong force, gravitational acceleration field.

1 Introduction to Big G as a Composite Constant and Planck Quantization of Newton

The role of Newton's gravitational constant is to calibrate data generated by empirical observations in order to get Newton's theory of gravity to work. In addition, the inverse is also possible: Newton's theory can combined with gravitational observations to find the gravitational constant. In 1798, Cavendish was the first to indirectly measure the gravitational constant; see [1].

One hundred years later, in 1899, Max Planck [2] first described his natural units, which he thought represented something fundamental and deep. He derived the Planck length, the Planck second, the Planck mass, and the Planck temperature (energy) from what he assumed were the most fundamental constants, namely the speed of light, Newton's gravitational constant, and the Planck constant; see also [3]. The Planck length was given by Planck himself as

$$l_p = \sqrt{\frac{G\hbar}{c^3}} \tag{1}$$

Based on this, it has always been assumed that the Planck length is a derived constant and the gravitational constant is a more fundamental constant. However, from the formula above we can see that this can be rewritten so that the gravitational constant is a function of the Planck length, the speed of light, and the Planck constant

$$G = \frac{l_p^2 c^3}{\hbar} \tag{2}$$

This is Haug's suggested way to look at the gravitational constant as a composite constant; see [4, 5, 6, 7]. This can also be derived from dimensional analysis, and in fact, it is not so strange that one can derive the gravitational constant from dimensional analysis assuming the Planck length, the speed of light, and the Planck constant are

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the fundamental constants, even if that not should be given too much weight. It is basically just flipping the Planck coin around, so to speak. In 2013, McCulloch [8] derived basically the same gravitational constant based on Heisenberg's uncertainty principle. Further, Haug [9] has also derived the same composite gravitational constant using Heisenberg's uncertainty principle in combination with his newly-introduced maximum velocity for matter.

Some physicists will likely protest here. Because we can measure the gravitational constant, and one can mistakenly assume that the Planck length must be derived from it. In this view claiming the gravitational constant is a composite constant seems to introduce a circular problem, at least until recently. Haug [6] has shown that the Planck length can be found from a Cavendish-style experiment without any knowledge of big G. The Planck length, as a logical idea that we can relate to, is simply a length, and likely the shortest length we can ever measure, even hypothetically. Studying this length in greater depth, Haug has also recently shown that for all observable gravity phenomena, only one of the Planck lengths in the gravitational composite constants cancel out in the corresponding formulas. In other words, the Planck length is always there, at least in gravity calculations above the subatomic scale. Thus, all observable gravitational phenomena seem to be dependent on the Planck length. Continuing along the track of measurements that are intuitive, the speed of light is also something we can easily relate to: it represents how far the light has moved during a given time interval. Of these fundamental constants, only the Planck constant is hard to conceptualize and therefore leads us to different story that is discussed in [6].

Another strong indication that the gravitational constant is a composite constant may be seen in its units, which are $m^3 \cdot kg^{-1} \cdot s^{-2}$. It would be very strange if something concerning the fundamental nature of reality would be meters cubed, divided by kg and seconds squared. What kind of exotic animal is that? If it quacks like a composite, it most likely is a composite.

There is yet another argument that strengthens our hypothesis that Newton's gravitational constant is a composite constant. In 2014, McCulloch published an interesting paper where he derives Newton's gravitational formulation based on Heisenberg's uncertainty principle utilizing the Planck mass [8]. We will argue this might only be possible if the Planck length (and therefore the Planck mass) plays a special role, even for macroscopic gravitational phenomena.

As previously shown by Haug [4], all of the Planck units are much simpler to understand from a logical point of view when we replace big G with its composite structure. In the standard Planck units, one can find c^7, c^8, and even c^9. What is the intuition of the light speed powered to the seven, or even to the nine? When we replace big G with its composite structure, no Planck unit has more than c^2 in its formula. Suddenly things start to make logical sense. And if we have two theories that give the same result, shouldn't we give preference to the simpler theory? We can leave such philosophical questions for another day. However, we will show that using the composite structure of Newton's gravitational constant can take us one step further; we will obtain a gravity prediction, different than what is predicted by GR and by Newton, that actually can be tested.

2 Mass and Energy under Atomism

We suggest that the key to developing a consistent theory of quantum gravity is to understand that Newton's gravitational constant is a composite constant and also to grasp how it should be adjusted to hold for things such as light as well. To do this properly, it is helpful to understand something about the recent rise of atomism.

In recent years, Haug has published a new theory rooted in ancient atomism, which holds that at the deepest level of nature, there only exists one indivisible particle and empty space (void) that makes up all matter and energy. This particle always moves at a constant speed, which must be the speed of light, except when it is colliding with another indivisible particle. The collision lasts for only one Planck second. This particle has no rest-mass and therefore no mass when it is moving; it only has mass when it is colliding. The collision point between indivisible particles are what modern physicists calls mass. Viewed in the light of atomism, this leads to a invariant Planck mass particle, a invariant Planck second, and a invariant Planck length.

In his book [10] and a series of papers, Haug has shown that, based on such postulates, one must get the same mathematical end results as Einstein's special relativity theory as long as one uses Einstein-Poincaré synchronized clocks. In addition, he gets an upper limit on the maximum velocity matter can take, which leads to a series of maximum limits on kinetic energy, proper velocity, maximum acceleration, and more. Under modern physics, even an electron can basically attain any level of kinetic energy as long as it is below infinity. However, is a limit that almost reaches infinity, really that different than on that truly does touch infinity? Bear in mind that we know that the latter is impossible, as it would require an infinite amount of energy; see [11] for interesting examples. Modern physics has no clear mechanism to explain why an electron not can achieve a relativistic mass equal to one kg, or even equal to the rest-mass of the Moon or the Earth.

There is a solid mathematical and logical framework behind this renewed atomism theory and the view of matter and energy in atomism plays a central role to produce a simple Newtonian type theory of quantum gravity that predicts the observed bending of light, something classical Newtonian gravity not do.

3 Back to the Planck Mass

While Max Planck was the first to describe the natural unit of a Planck mass, he said little about what it represented, except that it likely was related to something very fundamental. Actually, what the Planck mass is related to and if it means something special is still a mystery in modern physics. We might ask, "Does a Planck mass particle even exist?"

Lloyd Motz, while working at the Rutherford Laboratory in 1962, [13, 14, 15] suggested that there was probably a very fundamental particle with a mass equal to the Planck mass. Motz named this particle the *Uniton*.[1] Motz suggested that the Uniton could be the most fundamental of all particles and that all other particles were initially made of Unitons. Motz acknowledged that his Unitons (Planck mass particles) had far too much mass compared to known subatomic masses. He tried to get around this issue by claiming that Unitons had radiated most most of their energy away:

> According to this point of view, electrons and nucleons are the lowest bound states of two or more Unitons that have collapsed down to the appropriate dimensions gravitationally and radiated away most of their energy in the process. – Lloyd Motz

Others have suggested that there were plenty of Planck mass type particles around just after the Big Bang, see [16], but that most of the mass of these super-heavy particles has radiated away. Modern physics has also suggested a hypothetical Planck particle that has $\sqrt{\pi}$ more mass than the Uniton suggested by Motz. Some physicists including Motz and Hawking have suggested such particles could be micro-black holes [17, 18, 19]. Planck mass particles have even been suggested as a candidate for cosmological dark matter, [20, 12]. We must admit we are very skeptical towards dark matter, but that is beyond the scope of this paper.

In 1979, Motz and Epstein [18] suggested there likely existed a fundamental particle with half the Planck mass that could be essential to solve the mysteries of gravity. Motz and Epstein may have been the first to suggest a fundamental particle with this mass. Although, the Planck mass is still considered more or less to be an unsolved problem today, we think that the recent rapid advancement of mathematical atomism may provide a compelling answer to this longstanding challenge. Based on atomism, Haug [10] [21] has suggested that there is indeed is an essential half Planck mass particle. [2] Under atomism, this is an indivisible particle always moving at the speed of light as measured with Einstein-Poincaré synchronized clocks. When moving at the speed of light, it is mass-less. Only when colliding with another indivisible does it have mass, or we could say it is then mass. Actually, an indivisible particle's collision with another indivisible particle constitutes the only true mass, and when not colliding, it is energy. The mass of two colliding indivisible particles is the Planck mass particle. Since the Planck mass particle consists of two indivisible particles, then a single indivisible particle is half of this, and therefore has half the Planck mass as rest-mass. The so-called reduced Compton wavelength of a Planck mass particle is the Planck length

$$\bar{\lambda} = \frac{\hbar}{m_p c} = l_p \tag{3}$$

And naturally we can also use the reduced Compton wavelength in combination with the Planck constant and the speed of light to calculate the rest-mass of a particle

$$m_p = \frac{\hbar}{\bar{\lambda}} \frac{1}{c} = \frac{\hbar}{l_p} \frac{1}{c} \tag{4}$$

The diameter of the indivisible particle is the Planck length, and the distance between center to center between two indivisible particles correspond to the reduced Compton wavelength of the mass in question. This means the minimum reduced Compton wavelength is, in this theory, the Planck length.

Again, two indivisible particles need to collide to create this mass. The collision is the pure mass. Each indivisible, therefore, has a rest-mass of half of this. This means even if an indivisible particle does not have a reduced Compton wavelength, it must have an equivalent reduced Compton wavelength of $2l_p$. This is a very important point.

For example, an electron has a reduced Compton wavelength of $\bar{\lambda}_e$. This reduced Compton wavelength is enormous compared to the Planck mass particle's reduced Compton wavelength. The electron is, under this theory, simply two indivisible particles each traveling back and forth over the reduced Compton wavelength and colliding. This means we have $\frac{c}{\bar{\lambda}_e} \approx 7.76344 \times 10^{20}$ collisions per second in an electron. Each collision is a Planck mass, but each collision only lasts for one Planck second. The mass of the electron can be written as

$$\frac{c}{\bar{\lambda}_e} m_p \frac{l_p}{c} = \frac{\hbar}{\bar{\lambda}_e} \frac{1}{c} \approx 9.10938 \times 10^{-31} \text{ kg} \tag{5}$$

Since the electron consists of two indivisible particles, the shortest distance we can have between them is the Planck length. The maximum distance between two indivisible particles making up an electron is $2\bar{\lambda}_e$ and the

[1] See also [22] that introduces a similar particle that he calls Maximons.

[2] It is also important to understand that we thought and wrote about this long before we tried to derive a quantum gravity theory.

minimum distance is l_p (the later is what we could call the collision point wavelength embedded in any mass). The average distance is its reduced Compton wavelength.

Further, when an electron is moving, it is the reduced Compton wavelength that undergoes length contraction as observed with Einstein-Poincar é synchronized clocks from the stationary frame. The indivisible particles with diameter equal to the Planck length cannot undergo length contraction.[3]

Clearly, the Planck length plays an important role in relation to certain aspects of all matter.

- The Planck length is the shortest reduced Compton wavelength any elementary particle can have.
- Any elementary particle traveling at its maximum Haug velocity, see [4, 23], will in the limit get a reduced Compton wavelength equal to the Planck length. Actually Lorentz symmetry is broken at the Planck scale. Something that also possibly explains why gravity not is symmetrical. If two people measure time dilation, the first person from the top of a mountain and the second person from the deepest point in a valley, both will agree that the clock at the top of the mountain is going faster. Gravity is, at the depth of reality high energy physics, but over incredibly short time intervals of one Planck second.
- At the very depth of reality there is actually only one type of mass, the Planck mass particle, this is the building blocks of all other elementary particles. The Planck mass particle only lasts for one Planck second; it is more correct to call it 1.17337×10^{-51}kg. The Planck mass particle is the only mass that is observationally time dependent when we operate with our definition of mass. The Planck mass particle is one Planck mass when the observational time window is one Planck second; see [24]. The Planck mass particle is surprisingly the mass-gap.

The Planck length is reduced Compton wavelength of all fundamental particle when traveling at their maximum velocity. The Planck length is also what we can call the contracted "wavelength" of all elementary particles, such as the electron. In our theory there is only one pure mass, which is the Planck mass particle that only lasts for one Planck second. All non- Planck mass particles are, in this model, rapidly fluctuating between being energy and mass. All things that "normally" have rest-mass therefore have a contracted "wavelength" equal to the Planck length. This could pay a central role in building a new theory of quantum gravity.

There is only one exception here, which concerns individual indivisible particles (light is a series of these traveling after each other). These particles have an equivalent reduced Compton wavelength of $2l_p$. Be aware that this then must hold for any photon, despite different wavelengths of light. The reduced Compton wavelength of light is actually $2l_p$ and independent of the wavelength of light. This plays an important role in understanding our quantum gravity theory. For example, light with different wavelengths don't bend differently. Light under atomism correspond to the old Newton view, that light is composed of indivisible particles traveling after each other at the speed of light. A photon with a wavelength must be minimum two indivisible particles traveling after each other. No matter if the distance between the two indivisible particles for example where 500 nanometers or one femtometer, the reduced Compton wavelength of light is always twice the Planck length. We could also call it the light particle's mass length to distinguish it from the wavelength of light (the distance between indivisible particles traveling in the same direction after each other).

What is most important to keep in mind from this section is simply that all masses are somehow related to the Planck length, while light is linked to twice the Planck length.

4 Modifying the Newton Composite Constant Based on Atomism

So our hypothesis is simply that Newton's gravitational constant is a composite constant. And when we understand this we can look at the different parts of this composite constant and see if any of them need adjustments for "special situations." These adjustments should not be based on just fudging the parameters. In other words, we should not just simply manipulate the different parts of the composite constant without having a fundamental reason to do so. We will suggest that the gravitational constant actually should be modified from $G = \frac{l_p^2 c^3}{\hbar}$ to

$$G_m = \frac{\hat{\lambda}_1 \hat{\lambda}_2 c^3}{\hbar} \tag{6}$$

where $\hat{\lambda}_1$ and $\hat{\lambda}_2$ is related to the mass one and the mass two in the Newtonian formula. Based on this we get a Newtonian quantum gravity formula of

$$F = G_m \frac{m_1 m_2}{r^2} = \frac{\hat{\lambda}_1 \hat{\lambda}_2}{\hbar} \frac{m_1 m_2}{r^2} \tag{7}$$

[3]The relationship is simply $\frac{mc^2}{\sqrt{1-\frac{v^2}{c^2}}} = \frac{\frac{\hbar}{\bar{\lambda}}\frac{1}{c}c^2}{\sqrt{1-\frac{v^2}{c^2}}} = \frac{\hbar}{\bar{\lambda}\sqrt{1-\frac{v^2}{c^2}}}\frac{1}{c}c^2$

Based on our mass and energy analysis rooted in atomism we expect that $\hat{\lambda}_1$ and $\hat{\lambda}_2$ should be set equal to the Planck length when working with masses larger or equal to the Planck mass. Then one obtains identical outputs as the Newtonian formula. However, if one mass is light, then what is the rest-mass of the building blocks of light. We have already explained that the only pure mass under atomism is the collision between two indivisible particles, and that this mass is the Planck mass, but that it only can last for one Planck second before turning into energy again.

As we have seen in the section above, the reduced Compton wavelength of individual indivisible particles (light) is always twice the Planck length. This because its rest-mass or its potential rest-mass when moving is half the Planck mass. This is essential to understanding such things as bending of light.

5 Bending of Light

In 1884, Soldner predicted the following deflection of light, based on Newton's classical mechanics

$$\delta_S = \frac{2Gm}{c^2 r} \tag{8}$$

In 1911, Einstein obtained the same formula of light bending when he derived it from Newtonian gravitation, see [25]. The angle of deflection in Einstein's general relativity theory [26] is twice that one gets from Newtonian gravity

$$\delta_{GR} = \frac{4Gm}{c^2 r} \tag{9}$$

The solar eclipse experiment of Dyson, Eddington, and Davidson performed in 1919 confirmed [27] the idea that the deflection of light was very close to that predicted by Einstein's general relativity theory. That is 1.75 arc-seconds compared to the 0.875 as predicted by Soldner's 1884 formula.[4] This was one of the main reasons general relativity took off and partly replaced or rather extended Newtonian gravitation. A draw back with general relativity theory is that it is very complex to understand and it does not seem to be consistent with the quantum world.

Sato and Sato [28] have suggested that it looks like the 2 factor (double of Newton) in observed light deflection likely are due to an unknown property of the photon rather than the bending of space-time. This is exactly what we get from atomism that leads to our Newtonian quantum gravity theory.

The relationship between the angle of the asymptote to the hyperbole of eccentricity ϵ is given by

$$\cos(\beta) = \frac{1}{\epsilon} \tag{10}$$

and the angle of deflection of light in Newton theory must be given by (see the figure, will appear first in the next version)

$$\delta = \pi - 2\beta = \pi - 2\left(\frac{1}{\epsilon}\right) \tag{11}$$

In other words, we need to find the orbital eccentricity. The orbital eccentricity is in some Newton deflection of light calculations [29] is given by

$$\epsilon \quad = \quad \sqrt{1 + \frac{2EL^2}{G_m^2 M_S^2 m^3}} \tag{12}$$

but we have to understand how this particular form of eccentricity comes into this form. Pay particular attention to the 2 factor in the formula. This type of orbital eccentricity can be found from

$$h^2 = GMa(1 - \epsilon^2) \tag{13}$$

where h is the specific angular momentum, $h = \frac{L}{m}$, and a is the is the length of the semi-major axis, and G is the gravitational constant. Solved with respect to the eccentricity ϵ we get

$$\epsilon = \sqrt{1 - \frac{h^2}{GMa}} \tag{14}$$

Next we are using the argument that the gravitational energy can be described as[5]

$$E = -\frac{GMm}{2a} \tag{15}$$

[4] In 1881, Soldner calculated the light deflection to be 0.84 arc-seconds based on less accurate knowledge of the mass of the sun and speed of light than we have today.

[5] See for example http://scienceworld.wolfram.com/physics/Eccentricity.html

Again we see the 2 factor, this basically corresponds to the energy for low velocity orbital objects (somehow similar to the kinetic energy approximation of $E \approx \frac{1}{2}mv^2$). Putting this energy formula into formula 14 we get the known formula 12.

$$\begin{aligned} \epsilon &= \sqrt{1 - \frac{h^2 E}{GMaE}} \\ \epsilon &= \sqrt{1 + \frac{h^2 E}{GMa\frac{GMm}{2a}}} \\ \epsilon &= \sqrt{1 + \frac{2h^2 E}{G^2 M^2 m}} = \sqrt{1 + \frac{2EL^2}{G^2 M^2 m^3}} \end{aligned} \tag{16}$$

However, for a photon we claim it must be wrong to use the gravitational energy formula above and thereby the eccentricity formula abov, because it is rooted in low velocity objects. Instead one should use the following version when dealing with "orbital" velocity objects moving at significant speed compared to that of light. A photon is clearly doing so as it moves at the speed of light, so in this case we must have

$$E = -\frac{GMm}{a} \tag{17}$$

This gives an eccentricity formula of

$$\epsilon = \sqrt{1 + \frac{Eh^2}{G^2 M^2 m}} = \sqrt{1 + \frac{EL^2}{G^2 M^2 m^3}}$$

and with respect to our composite gravitational constant we must have

$$\epsilon = \sqrt{1 + \frac{EL^2}{G_m^2 M^2 m^3}}$$

The energy to be used in the formula when dealing with bending of light we claim must be the photon rest-mass energy minus the gravitational energy.

$$E = mc^2 - G_m \frac{Mm}{R} \tag{20}$$

This lies in contrast to the kinetic energy approximation that only holds for low velocities, that is used in otherwise very interesting paper [6] by Soares [29]:

$$E = \frac{1}{2}mc^2 - G_m \frac{Mm}{R} \tag{21}$$

Since $\frac{1}{2}mc^2$ is a kinetic energy formula approximation for very low velocity it should not be used in this context where we deal with photons. Further, we claim that the (full) exact kinetic energy formula cannot be used for photons

$$E = \frac{mc^2}{\sqrt{1 - \frac{v^2}{c^2}}} - mc^2 - G_m \frac{Mm}{R} \tag{22}$$

setting $v = c$ we would get an infinite kinetic energy. So both the kinetic energy approximation (that only holds for low velocities) and the full kinetic energy formula do not seems to make sense when we work with photons. The kinetic energy formula is made for something that has rest-mass in its normal constitution, and not for light. Here we actually have to do with a photon traveling at the speed of light, but we will claim it is actually the rest-mass energy of the photon that is relevant here, and that is $E = mc^2$. This because only for a photon is all the rest-mass energy actually kinetic energy. The kinetic energy for a photon is, according to atomism, the very collision point between indivisible (light) particles, where the collision lasts for one Planck second. The collision is only changing the direction of the light particle, that is to say, the kinetic energy of light is a somewhat special case. Why is this? This is because all the rest-mass energy in a light particle is its kinetic energy as well.

Further, we have the angular momentum of the photon that is

$$L = mcR \tag{23}$$

We will claim that only a light particle can have momentum equal to mc, and this is actually directly linked to the Planck momentum, as the Planck mass momentum is always $m_p c$. Again, a light particle when colliding with another light particle

[6] To a large degree we have based our calculations on this paper by Soares.

is for one Planck second a Planck mass particle. Within one Planck second (basically the closest one likely ever can get to instantaneous) the Planck mass particle is again turning into energy.

A single light particle has an angular momentum of

$$L = mcR = \frac{\hbar}{2l_p}\frac{1}{c}cR = \frac{1}{2}m_pcR \tag{24}$$

this gives

$$\begin{aligned}
\epsilon &= \sqrt{1+\frac{EL^2}{G_m^2M^2mm^2}} \\
\epsilon &= \sqrt{1+\frac{\left(mc^2-G_m\frac{Mm}{R}\right)m^2c^2R^2}{G_m^2M^2m^3}} \\
\epsilon &= \sqrt{1+\frac{\left(c^2-G_m\frac{M}{R}\right)c^2R^2}{G_m^2M^2}}
\end{aligned} \tag{25}$$

Bear in mind that all the small m above actually are $=\frac{\hbar}{2l_p}\frac{1}{c}$, but we see they cancel each other out, but this has an impact on our G_m, something we will get back to later on. Since we for the Sun must have $G_m\frac{M_s}{R} << c^2$ we have

$$\epsilon \approx \sqrt{1+\frac{c^4R^2}{G_m^2M_S^2}} \tag{26}$$

and since $\frac{c^4R^2}{G_m^2M_S^2} >> 1$ we can approximate this very well as

$$\epsilon \approx \frac{c^2R}{G_mM_S} \tag{27}$$

The bending of light is given by

$$\delta = \pi - 2\arccos\left(\frac{G_mM_S}{c^2R}\right) = \pi - 2\arccos\left(\frac{\frac{l_p2l_pc_3}{\hbar}M_S}{c^2R}\right) \tag{28}$$

and the reason we have $G_m = \frac{l_p2l_pc^3}{\hbar}$ instead of $G_m = \frac{l_pl_pc^3}{\hbar} = G$ is because here we have to do with a standard mass (the Sun) versus light (the light beam). And the light particles making up a photon each have half a Planck mass in rest-mass and therefore even if it doesn't have a reduced Compton wavelength per se we think it is relevant to claim it must have an equivalent reduced Compton wavelength of $2l_p$. Again remember that this rest-mass only lasts for one Planck second at collision.

Further, we can expand $\arccos(x)$ since $x = \frac{G_mM_S}{c^2R} << 1$ using a Taylor series expansion, this gives

$$\arccos(x) = \frac{\pi}{2} - \arcsin(x) = \frac{\pi}{2} - \left(x - \frac{x^3}{6} + \frac{3x^5}{40}\cdots\right) \tag{29}$$

Using only the first part of the Taylor series expansion we get

$$\delta \approx \pi - 2\left(\frac{\pi}{2} - \frac{\frac{2l_p^2c^3}{\hbar}M_S}{c^2R}\right) = \frac{4\frac{l_p^2c^3}{\hbar}M_S}{c^2R} = \frac{4GM_S}{c^2R} \approx 1.75 \text{ arc seconds} \tag{30}$$

This in strong contrast to Soares [29] who uses the same approach deriving Newton deflection, but based on the non-modified G. He correctly gets the traditional Newton bending of light that is half of the above. Still, we will claim Soares has made a technical mistake in his derivation using the kinetic energy approximation that clearly not should be used for light, as it is an approximation that only holds when $v << c$. This is partly understandable, as the full kinetic energy formula cannot be used either, since it returns infinity for light. The light particle is special and we must return to atomism to get the proper insight to understand the rest-mass of light particles. However, even when using the wrong kinetic energy formula Soares has obtained the right answer for Newton bending of light, as he also indirectly has used the low energy approximation for the orbital eccentricity (the 2 factor in his eccentricity formula seems to come from this.). It would seem that the two errors have canceled each other out.

Even Soares' approach is indirectly hinting that there is something special about the photon since the normal kinetic energy framework cannot be used, nor the slow velocity approximation, nor the exact relativistic kinetic energy formula. Because it is clear that the kinetic energy approximation formula and the full exact kinetic energy formula for standard rest-mass cannot be used for pure energy (light).

For a photon neither can the kinetic energy approximation formula be used, nor the full kinetic energy formula. The rest-mass energy must be used. Light is special, it has rest-mass when colliding for one Planck second, in other words, all of its rest-mass is actually kinetic energy.

It seems like the atomism understanding of energy and matter combined with understanding that the Newton gravitational constant is a composite gives the correct bending of light prediction. From our derivation above, our theory also seems to predict that the bending of light in a highly accelerated electron beam would be only the Newton bending of light. Has this been tested? If not, then it should be: a high energy beam of electrons could be sent from Earth, and a spaceship with a measurement device could try to measure this. In short, our theory predicts something different than GR that likely could be tested.

6 Gravitational Red-Shift and Gravitational Time Dilation

Gravitational red-shift and time dilation are basically just a function of the escape velocity. The escape velocity from Newton gravity is typically always calculated by solving the equation below with respect to v

$$\begin{aligned} \frac{1}{2}mv^2 - G\frac{Mm}{R} &= 0 \\ v^2 - 2G\frac{M}{R} &= 0 \\ v = \sqrt{2\frac{GM}{R}} & \end{aligned} \tag{31}$$

This is also the same escape velocity one gets from Einstein's general relativity using the Schwarzschild metric, see [30]. Please notice that the equation above is solved from the kinetic energy approximation that only holds when $v << c$. Light is moving at speed c, so this formula should clearly not hold for light. Also, the full kinetic energy formula cannot be used as it would lead to infinity when $v = c$, as it must be for the light. We have to understand that light is special; we claim it is the rest-mass formula that must be used for light, so in other words we must have

$$\begin{aligned} mc^2 - G_m\frac{Mm}{R} &= 0 \\ v^2 - G_m\frac{M}{R} &= 0 \\ v &= \sqrt{\frac{G_m M}{R}} \end{aligned} \tag{32}$$

However, because we now has to do with light we have that $G_m = \frac{l_p 2 l_p c^3}{\hbar} = 2G$ rather than $G_m = \frac{l_p l_p c^3}{\hbar} = G$ as we would have for any non-light moving object. Even in our theory we get the same escape velocity as before

$$v = \sqrt{\frac{G_m M}{R}} = \sqrt{\frac{l_p 2 l_p c^3}{\hbar}\frac{M}{R}} = \sqrt{2\frac{GM}{R}} \tag{33}$$

As basically only the escape velocity is needed to calculate gravitational time dilation, red-shift, and gravitational acceleration. This means we get the same as Newton and General Relativity here.

7 Modified Gravitational Acceleration Field

The acceleration field is unrealistically low under classical Newtonian physics at the Schwarzschild radius. And yet the escape velocity at the Schwarzschild radius is always the speed of light, as we think it should be. Assume a super-massive object that is 10^{14} solar masses. The gravitational acceleration field at the Schwarzschild radius is, under Newton's universal gravitation, only

$$g = \frac{GM}{R^2} = \frac{GM}{2\frac{GM}{c^2}} \approx 0.152 \text{ m}/s^2 \tag{34}$$

How can the escape velocity be c and at the same time is the surface gravity field much weaker than that on Earth, where it is about 9.8 m/s^2? According to Einstein's General Relativity theory, the gravitational acceleration field under

the Schwarzschild metric is supposedly going towards infinite strength at the Schwarzschild radius. We will suggest that no acceleration field can be stronger than the Planck acceleration field:

$$a_p = \frac{c^2}{l_p} \approx 5.56092 \times 10^{51} \text{ m}/s^2 \tag{35}$$

If the shortest possible time interval something can undergo acceleration is one Planck second, then if an object undergoes Planck acceleration for this time interval it will reach the speed of light:

$$a_p t_p = \frac{c^2}{l_p}\frac{l_p}{c} = c \tag{36}$$

As matter cannot travel at the speed of light, in our interpretation this means only a Planck mass particle can undergo this acceleration. As shown by Haug in a series of papers, the Planck particle is likely at absolute rest and is within one Planck second dissolving into pure energy. This also explain why the mass can accelerate from rest-mass to speed c within a Planck second; it has to dissolve into pure energy in this time-frame. And from mathematical atomism only the Planck mass particle can do this within a Planck second. Anyway we will assume the Planck acceleration is what we have at the Schwarzschild radius. Further, we will assume the inverse square rule basically holds from a radius going out from the Schwarzschild radius rather than from the very center of the mass. Based on this our suggested somewhat ad-hoc modified formula for gravitational acceleration field is

$$\begin{aligned} g &\approx \frac{GM}{r^2 - \left(\frac{2GM}{c^2}\right)^2 + \left(\frac{GM}{c^2}\right) l_p} \\ g &\approx \frac{c^2 N l_p}{r^2 - (2Nl_p)^2 + N l_p^2} \end{aligned} \tag{37}$$

The acceleration field now for a 10^{14} solar mass object at the Schwarzschild radius, $r = \frac{2GM}{c^2}$ gives

$$g \approx \frac{GM}{r^2 - \left(\frac{2GM}{c^2}\right)^2 + \left(\frac{GM}{c^2}\right) l_p} = \frac{GM}{\left(\frac{2GM}{c^2}\right)^2 - \left(\frac{2GM}{c^2}\right)^2 + \left(\frac{GM}{c^2}\right) l_p} = \frac{c^2}{l_p} \approx 5.56092 \times 10^{51} \text{ m}/s^2 \tag{38}$$

Next, the mass of the Earth is approximately 2.74388×10^{32} Planck masses. Further, the radius of the Earth is 6,371,000; this gives an acceleration field of the Earth at the surface of Earth equal to

$$g \approx \frac{c^2 N l_p}{r^2 + N l_p^2 (1 - N)} = \frac{c^2 \times 2.74388 \times 10^{32} \times l_p}{6371000^2 + (2 \times 2.74388 \times 10^{32} \times l_p)^2 - 2.74388 \times 10^{32} \times l_p} \approx 9.8194 \ m/s^2$$

Still, this formula always gives the Planck acceleration at the modified Schwarzschild radius. We have not investigated this ad-hoc adjustment too well yet, and it should be investigated further for possibly weaknesses.

8 When Inside the Nucleus "Radius"

Assume we have two protons, the classical Newton gravity is then given by

$$F = G\frac{m_P m_P}{\bar{\lambda}_P^2} \approx 4.22139 \times 10^{-33} \tag{39}$$

This is about 10^{38} times weaker than the strong force. In our theory of quantum gravity we speculate that when dealing with protons at the distance of the reduced Compton wavelength of the proton then $\hat{\lambda}_1 = \bar{\lambda}_P$ and $\hat{\lambda}_1 = \bar{\lambda}_P$. This leads to a gravity force of

$$F = G_m \frac{m_P m_P}{\hat{\lambda}_P^2} = \frac{\bar{\lambda}_P \bar{\lambda}_P c^3}{\hbar}\frac{m_P m_P}{\bar{\lambda}_P^2} \approx 714794.9058 \tag{40}$$

Between two protons we would get a gravitational force of about $\frac{G_m}{G} = \frac{\bar{\lambda}_P \bar{\lambda}_P}{l_p^2} \approx 1.69 \times 10^{38}$ times the force that would be predicted in the conventional gravity formula today. That is the same as the difference between the gravity force and the strong force. We agree especially this part is quite speculative, but we think it is worth investigating this path further, in particular when we know how little success other quantum gravity theories have had despite the efforts of many physicists who have worked on them for years. A simple theory that seems to be able to explain a lot should not simply be brushed under the carpet.

Our main point is that Newton gravity, when truly understood from a deeper perspective, can easily be modified to become a type of quantum gravity theory. This is embedded in the composite Newton gravitational constant. Exactly how it should be used in special situations such as inside the proton is difficult to say, but the fact that we, by the most logical possible change, find the gravity force suddenly seems to be equal to the strong force is interesting and deserve further studies.

9 Perihelion of Mercury

Supposedly one of the greatest achievements of general relativity was to predict the perihelion of Mercury correctly. At least in its original form the Newtonian theory cannot predict this. The question is if a small relativistic adjustment can do so. This is a question we will hold for future research.

10 Summary

Here we will shortly summarize some of our findings.

- In Newton's quantum gravity theory the gravitational "constant" takes the same value as today as long as we are working with two objects larger than or equal to the Planck mass.
- Newton's quantum gravity theory surprisingly predicts the same gravitational bending as GR for light, but it is based on a much simpler model with postulates on what the ultimate building blocks are. We have $\delta = 2\frac{G_m M}{c^2 R} = 4\frac{GM}{c^2 R}$ when dealing with light. That is for photon beams we have $G_m = \frac{l_p 2 l_p c^3}{\hbar} = 2G$.
- Newton's quantum gravity theory seems to predict that the bending of beams that are not light will be $\delta = \frac{G_m M}{c^2 R} = 2\frac{GM}{c^2 R}$. This is a prediction not given by GR. This could possibly be tested out by electron beams or proton beams. For non-photon beams we have $G_m = \frac{l_p^2 c^3}{\hbar} = G$.
- Newton's quantum gravity theory seems to give the same predictions as GR for time dilation, gravitational red-shift, etc.
- When it comes to the gravitational acceleration field we have suggested a modification that makes the field equal to the Planck acceleration at the Schwarzschild radius. For weak gravitational fields we still get the same as predicted by Newton.
- When being all the way down to nucleus we have reason to think the quantum gravity force could be the same as the strong force; our model indicates that this is so, even if some would call it a bit ad-hoc.
- In Newton's quantum gravity the speed of gravity moves at the speed of light. This is already hidden inside Newton's gravitational constant. We could say that Newton's gravitational theory is consistent with the speed of gravity being the speed of light, but that this is first clear when we have modified it into a Newtonian quantum gravity theory.

Newton's quantum gravity is much simpler than General Relativity theory and is rooted in a theory of atomism. Table 1 illustrates the main differences between this gravity theory and Newtonian gravity and General Relativity theory.

Case:	**Result**
Speed of gravity	Speed of light
Time dilation	Same as GR (and Newton).
Red-shift	Same as Same as GR (and Newton).
Gravitational acceleration field	Different than GR and Newton.
Deflection light beam	Same as GR, twice of Newton.
Deflection electron beam	Same as Newton for light, half of GR.

Table 1: The table of a series of measurements that can be observed and measured in relation to gravity, and the gravitational force that we cannot observe or measure.

Case:	**Result**
When working with two rest-masses	$G_m = \frac{\hat{\lambda}\hat{\lambda}c^3}{\hbar} = \frac{l_p l_p c^3}{\hbar} = G.$
When working with light	$G_m = \frac{\hat{\lambda}\hat{\lambda}c^3}{\hbar} = \frac{l_p 2 l_p c^3}{\hbar} = \frac{2 l_p^2 c^3}{\hbar} = 2G.$
When working at proton scale At distance =proton	$G_m = \frac{\hat{\lambda}\hat{\lambda}c^3}{\hbar} = \frac{\bar{\lambda}_P^2 c^3}{\hbar} = \frac{\lambda_P^2}{l_p^2} G.$

Table 2: The table of a series of measurements that can be observed and measured in relation to gravity, and the gravitational force that we cannot observe or measure.

Table two illustrates how we think Newton's composite gravitational constant should be used for different "special" situations.

11 Is Gravity a Special Aspect of High Energy Physics?

Since we can use simple gravity experiments to extract the Planck length without even knowing anything about the gravitational constant, then could it actually be that gravity is a very special type of high energy physics. This sounds totally contrary to what one should believe based on modern physics because here gravity is considered such a weak force. But what if gravity experiments, like the Cavendish experiment, basically reflect an indirect measurement of very high energy physics that only lasts for incredible short periods of time?

If each gravity event is of a Planck energy size event, but only lasts for one Planck second, then for each gravity event it is more correct to say is $1.05457 \times 10^{-34} J$. Bear in mind that the units of Joule are $kg \cdot m^2 \cdot s^{-2}$. In other words, time is essential to energy. When we have to do with an incredible strong energy over an incredible short time interval, that is much shorter than we are even close to measuring today, then this strong, short-duration energy will appear to be a very weak energy. Then the only way we can measure this is by having an enormous amount of these high-energy very short-lived events.

To observe an energy event that is only $1.05457 \times 10^{-34} J$ one would indeed need a high volume of these events. And when working with gravity observations we are using macroscopic masses, which will lead to a massive number of these high energy, very short-lived events.

The mystical thing is that by using macroscopic objects we can actually measure the shortest of all length, and thereby also find the Planck mass totally independent of big G using a Cavendish experiment set-up.

And after all it is the gravity force that holds the Moon in orbit around the Earth; it is not some electromagnetic force. In one of the last articles Victor Stenger wrote before he passed away, he questioned what he called "Myths of Physics Gravity Is Much Weaker Than Electromagnetism.'.

What if gravity is a very strong force, and that it is quantized, but that each high energy gravity event only lasts for one Planck second. Then gravity measurement is a kind of high energy physics, where one is capturing an enormous amount of these high energy, extremely short-lived events. Gravity has indeed led us to the Planck length, the Planck mass, and the Planck time. The Planck mass is enormous compared to any observed subatomic particle. But what if the reason simply is that the Planck mass particle only lasts for one Planck second?

Not only can we find the Planck length and thereby the Planck mass and the Planck time through the dimensional analysis of Max Planck, but we can also find the Planck length, the Planck mass, and the Planck time from a Cavendish style set-up with no knowledge of big G, see [6]. What we need is knowledge about the speed of light and the Planck constant. In addition, we think that it is no coincidence that any elementary mass can be written in the form

$$m = \frac{\hbar}{\bar{\lambda}} \frac{1}{c} \tag{41}$$

Modern physics has not taken this literally. Atomism gets the same formula when derived from scratch; here it is obvious that the speed of light is related to indivisible particles moving back and forth inside mass at the speed of light and colliding. At the collision point the distance center to center of two indivisible particles is the Planck length.

We are quite certain gravity is related to the collision point of the indivisible particles that make up the mass. Half of this mass is the light particle (the indivisible itself) and therefore we end up with some minor adjustments of Newton's gravity theory that gives the right prediction of light bending, but also seems to give a new prediction on non-light beams that are half of that as predicted by GR.

12 Conclusion

We have pointed out that Newton's gravitational constant is most likely a composite constant. Next we have, based on new ideas about energy and mass at the most fundamental level, suggested how the composite gravitational constant must be modified when we have to deal with light and other special situations.

Our Newtonian quantum gravity theory gives the same prediction of bending of light as General Relativity theory. For non-light beams such as electrons our theory seems to predict that they only would bend half as much as light. That is we get a Newton bending of light for electron beams, but a GR bending when we deal with light.

Further, we have suggested a modification of the gravitational acceleration field equation. Our modified formula always gives Planck acceleration at the Schwarzschild radius, and at the same time it gives the same values as Newton when we are in weak gravitational fields.

In addition, our theory suggests that the gravitational force is equal to the strong force when we are considering distances within the nucleus of an atom.

We admit our theory is somewhat speculative. However, as with any emerging scientific theory, we strongly recommend studying recent developments in mathematical atomism closely before coming to any conclusions about this new theory of quantum gravity.

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