The Mass Gap, Kg, the Planck Constant and the Gravity Gap
Is Planck's Constant a Composite Constant ?
One kg Is $852246550435748 \times 10^{36}$ Collisions per Second
The Mass Gap Is 1.1734×10^{-51} kg and also m_p
The Possibility of EmDrive?

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Abstract

In this paper we discuss and calculate the mass gap. Based on the mass gap we are redefining what a kilogram may truly represent. This enables us to redefine the Planck constant in what we consider to be more fundamental units. Part of the analysis is based on recent developments in mathematical atomism. Haug [1, 2, 3] has shown that all of Einstein's special relativity mathematical end results [4] can be derived from two postulates in atomism. However, atomism gives some additional boundary conditions and removes a series of infinite challenges in physics in a very simple and logical way.

While the mass gap in quantum field theory is an unsolved mystery, under atomism we have an easily defined, discrete, and "exact" mass gap. The minimum rest-mass that exists above zero is 1.1734×10^{-51} kg, assuming an observational time window of one second. Under our theory it seems meaningless to talk about a mass gap without also talking about the observational time window. The mass gap in one Planck second is the Planck mass. Further, the mass gap of just 1.1734×10^{-51} kg has a relativistic mass equal to the Planck mass. The very fundamental particle that makes up all mass and energy has a rest-mass of 1.1734×10^{-51} kg. This is also equivalent to a Planck mass that lasts for one Planck second.

In this paper we are not trying to solve the Millennium mass gap problem in terms of the Yang-Mills theory. We think the world is much better understood by atomism and its recent mathematical framework. Whether or not a link between these two theories exists, we may leave up to others to find out.

Keywords: Composite constant, kg, mass gap, Planck mass, relativistic mass, atomism, particle frequency.

1 Introduction

The Planck constant was introduced by Max Planck [5] in 1900. Planck's constant is linked to the idea that energy comes in quanta and plays a central role in all of quantum mechanics. The Planck constant is one of the fundamental constants that have been most accurately measured, in contrast to Newton's gravitational constant G, for example, where there still is considerable uncertainty in what its "exact" value should be. See [6, 7, 8], for example. Recent research related to the Watt balance also makes the Planck constant very central in relation to possibly redefining the kilogram; see [9, 10, 11], for example. In this paper we suggest that Planck's constant is a composite constant and by breaking it down into what it truly represents, we are able to better understand it. This in turn helps us to understand the mass gap, a subject that may be taken up again in the future.

Any fundamental particle mass can be written as

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

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where $\hbar$ is the reduced Planck constant, $\bar{\lambda}$ is the reduced Compton wavelength of the particle in question, and c is the speed of light[1] The output is then in units of kg. The speed of light is simply the distance light travelled for a given time period. The speed of light is typically given in meters per second. We all know roughly what a meter is and what a second is; they are something we can all relate to. Further, the reduced Compton wavelength is a length — again, we can relate to a length. On the other hand, the reduced Planck constant $\hbar$ in terms of SI units is given as kg$\cdot m^2/s$. I think few if any of us can relate to what this represents exactly, kg times meters squared per second. What kind of exotic animal is that? This complex notation alone seems to give a hint that the Planck constant is a composite constant that we can break down in far simpler and more intuitive fundamental constants.

2 The Mass Gap and the Kg

We will assume that at the very depth of reality there only exists one type of fundamental particle, namely indivisible particles, always moving at the speed of light; see [1, 2, 3]. In this model we will have a binary system of energy and matter. We have matter with rest-mass when two indivisible particles collide, and we can call the indivisible particles energy when they not are colliding. We assume these indivisible particles always move at the speed of light. An exception is in the very collision point when two indivisible particle counter-strike (collide) and changes their direction of movement. We will claim a single collision between two indivisible particles is equal to a mass of 1.1734×10^{-51} kg, if the observational period is one second. This is what we will call the mass gap. This is the minimum mass we can observe within a second; in other words, the mass gap within a second. If we look away from units for a moment, this is the same value as given by the reduced Planck constant divided by c^2:

$$\frac{\hbar}{c^2} \approx 1.1734 \times 10^{-51} \tag{2}$$

The units here are not in kg, something we will get back to soon.

Under atomism any known subatomic particle is rapidly fluctuating between mass (the mass gap) and 'internal' energy. Based on atomism (see [1, 2, 3]) mass is simply counter-strikes between indivisible particles. When two indivisible particles counter-strike (collide), we define this as mass, and when they do not counter-strike, they are internal energy. An electron, for example, can simply be thought of as two indivisible particles traveling back and forth, each over a distance equal to the reduced Compton wavelength of the electron. Based on this scenario, an electron has the following number of internal counter-strikes per second

$$\frac{c}{\bar{\lambda}_e} \approx 7.76344 \times 10^{20} \text{ counter-strikes per second} \tag{3}$$

The electron is rapidly fluctuating between energy and mass 7.76344×10^{20} times per second. This is likely somewhat related to Schrödinger's [12] hypothesis in 1930 of a Zitterbewegung ("trembling motion" in German) of the electron that he speculated was twice of the frequency above per second. Schrödinger did not seem to have an explanation of exactly what was behind this "trembling motion", but we think atomism has the answer. At each counter-strike we have a mass of 1.1734×10^{-51} kg. That is to say, the total rest-mass of an electron is

$$m_e = \frac{c}{\bar{\lambda}_e} m_g = \frac{c}{\bar{\lambda}_e} \times 1.1734 \times 10^{-51} \approx 9.1094 \times 10^{-31} \tag{4}$$

where m_g is the mass gap. The mass gap 1.1734×10^{-51} kg is interestingly also equal to the mass of one Planck mass for one Planck second. Looking away from units for a moment, we have

$$m_g = \frac{\hbar}{c^2} = m_p t_p \approx 1.1734 \times 10^{-51} \tag{5}$$

However, $\frac{\hbar}{c^2}$ is not the notation of kg, but rather kg$\cdot s$. In our atomist model if we have a time window of one second then the maximum reduced Compton wavelength we can have in a mass in order not to reach zero mass is

[1] More precisely the round-trip speed of light, or the one-way speed of light as measured with Einstein-Poincaré synchronized clocks.

$$\bar{\lambda}_g = \frac{\hbar}{m_g c} = 299792458 \text{ m} \tag{6}$$

where m_g is the mass in kg of the mass gap. We suggest that there is reduced Compton wavelength equal to the distance light travels in one second (when we operate with the speed of light in terms of meters per second). The reduced Compton wavelength with a distance equal to the distance the light travels per time unit chosen is conceptually important, as it is linked to the mass gap, in our view. Solved with respect to the mass gap, m_g, we get

$$m_g = \frac{\hbar}{\bar{\lambda}_g}\frac{1}{c} = \frac{\hbar}{299792458}\frac{1}{c} \approx 1.17337 \times 10^{-51} \text{ kg} \tag{7}$$

This is equal in value to $\frac{\hbar}{cc}$, but one of the c's is actually the reduced Compton wavelength (so not meters per second, just a distance of $\bar{\lambda}_g = 299792458$ meters), and now the output of the mass gap is in kg. This can be used to better understand what one kg truly represents at a deeper level. If one counter-strike is equal to the mass gap, then one kg must be equal to the following number of counter-strikes per second

$$\text{One } kg \text{ in terms of number of counter-strikes} = \frac{1}{m_g} = \frac{1}{1.17337 \times 10^{-51}} \approx 8.52247 \times 10^{50} \tag{8}$$

This shows that one kg is an enormous amount of counter-strikes between indivisible particles per second. One kg is related to 8.52247×10^{50} counter-strikes between indivisible particles per second. Based on this observation, we can also better understand the relationship between kg and fundamental particles such as electrons. The electron is counter-striking $\frac{c}{\bar{\lambda}_e} = 7.76344 \times 10^{20}$ times per second. As a fraction of the number of counter-strikes in one kg we find that an electron mass is

$$m_e = \frac{7.76344 \times 10^{20}}{8.52247 \times 10^{50}} = 9.10938 \times 10^{-31} \text{ fraction of the number of counter-strikes in one kg} \tag{9}$$

Any mass in kg is simply a fraction of the number of counter-strikes that exist in a kg. A mass in kg is a counter-strike ratio

$$\text{Particle mass in kg:} \ = \frac{\text{Counter-strikes in particle mass per time unit}}{\text{Counter-strikes in one kg mass per time unit}} \tag{10}$$

Further, based on this, the reduced Planck constant is simply

$$\hbar = \frac{c^2}{8.52247 \times 10^{50}} \tag{11}$$

And any fundamental particle, as a fraction of the number of counter-strikes in one kg, is given by

$$m = \frac{\hbar}{\bar{\lambda}}\frac{1}{c} =\approx \frac{\frac{c^2}{8.52247\times 10^{50}}}{\bar{\lambda}}\frac{1}{c} = \frac{c}{\bar{\lambda}}\frac{1}{8.52247 \times 10^{50}} \tag{12}$$

That is to say, any type of fundamental particle is simply the internal frequency of counter-strikes per second multiplied by the mass gap. The mass gap in terms of the fraction of kg counter-strikes is

$$m_g = \frac{1}{8.52247 \times 10^{50}} \approx 1.17337 \times 10^{-51} \text{ fraction of the number of counter-strikes in one kg} \tag{13}$$

3 The Mass Gap as a Function of the Observational Period

It is important to understand that if we observed a point different than one second, the mass gap could be smaller or larger than 1.17337×10^{-51} kg. If we use an observational time window shorter than one second, the mass gap will be larger than this, and if the observational time window is larger than one second, then the mass gap will be smaller than this. For a two-second period the mass gap is $\frac{m_g}{2}$ and for a three-second observation period the mass gap is $\frac{m_g}{3}$. The mass gap is simply one-counter-strike, but to talk about the mass in terms of kg we must compare one counter-strike with the number of counter-strikes in a kg during the same time period. And per our definition, one kg will be approximately 8.52247×10^{50} counter-strikes per second and naturally $2 \times 8.52247 \times 10^{50}$ per two seconds. One kg is always one kg, but the mass gap changes with the time window. Hypothetically, the shortest time window that is likely possible is one Planck second. In one Planck second, one kg is approximately 45,945,119 counter-strikes (the approximate number of Planck masses in one kg). And the mass gap is always one counter-strike, and one counter-strike as a fraction of the number of counter-strikes in one Planck second for a kg is

$$m_g \approx \frac{1}{45945119} \approx 2.17651 \times 10^{-8} = m_p \tag{14}$$

That is to say, the mass gap is one Planck mass for one Planck second. This is consistent with Haug's atomist model for anything with rest-mass, where he has claimed all known subatomic particles consist of Planck masses that lasts for one Planck second and this cycle is repeated many times per second based on the subatomic particle frequency. This also means that any mass with a mass larger than the mass gap (as measured in one Planck second) must consist of more than two indivisible particles. In this view, one fundamental particle most likely consists of two indivisible particles. However, there could be some modifications here without altering the main concept of our theory.

This does not mean that one kg has a lower mass the shorter the time period over which we measure. Using kg is simply making use of a standardized reference for a given amount of matter. If we observed the number of counter-strikes in one kg over half a second, then the number of counter-strikes in that kg would be $\frac{1}{2} \times 8.52247 \times 10^{50}$. Accordingly, the number of counter-strikes in any known subatomic particle would also be reduced in half compared to what they achieve in one second. The relative mass is practically "invariant" to what time frame we look at, as long as we work with observational time windows considerably larger than the reduced Compton time, see Haug [3] for a detail discussion on other masses than the mass gap. With reduced Compton time we mean the time it takes for the speed of light to pass the reduced Compton wavelength of the particle in question. The mass gap will vary for different time windows. This is because the mass gap as defined here always is only one counter-strike.

4 Frequency Summary

The table summarizes how mass for any subatomic particle, or even composite matter, can be described as a number of counter-strikes per second. One kg is the enormous amount of 8.52247×10^{50} counter-strikes per second and for any subatomic mass, if we want to convert it to kg, we can find the value by dividing the subatomic particle frequency with the number of counter-strikes that represent one kg.

	Mass as frequency counter-strikes per second	**Mass as kg "frequency ratio"**
Mass gap for one second	$m_g = 1$ [a]	$m_g = \frac{1}{8.52247\times10^{50}} \approx 1.1734 \times 10^{-51}$ kg
Electron	$m_e = \frac{c}{\bar{\lambda}_e} \approx 7.76344 \times 10^{20}$	$m_e = \frac{7.76344\times10^{20}}{8.52247\times10^{50}} \approx 9.10938 \times 10^{-31}$ kg
Meson	$m_m = \frac{c}{\bar{\lambda}_m} \approx 2.04949 \times 10^{23}$	$m_m = \frac{2.04949\times10^{23}}{8.52247\times10^{50}} \approx 2.40481 \times 10^{-28}$ kg
Muon	$m_M = \frac{c}{\bar{\lambda}_M} \approx 1.60523 \times 10^{23}$	$m_M = \frac{1.60523\times10^{23}}{8.52247\times10^{50}} \approx 1.88353 \times 10^{-28}$ kg
Planck mass	$m_p = \frac{c}{l_p} \approx 1.85492 \times 10^{43}$	$m_p = \frac{1.85492\times10^{43}}{8.52247\times10^{50}} \approx 2.17651 \times 10^{-8}$ kg
Proton mass	$m_P = \frac{c}{\bar{\lambda}_P} \approx 1.42549 \times 10^{24}$	$m_P = \frac{1.42549\times10^{24}}{8.52247\times10^{50}} \approx 1.67262 \times 10^{-27}$ kg
One kg	8.52247×10^{50}	$\frac{8.52247\times10^{50}}{8.52247\times10^{50}} = 1$ kg
One kg	45945119.23 (per Planck second)	$\frac{45945119.23}{45945119.23} = 1$ kg
Mass gap for one Planck second	$m_g = 1$ [b]	$m_g = \frac{1}{45945119.23} \approx 2.17651 \times 10^{-08}$ kg

Table 1: The table shows how subatomic particle masses can be expressed as "clock" frequencies and that kg simply can be seen as a standardized frequency ratio.

[a] The mass gap could be less than one counter-strikes per second, the mass gap is 1 counter-strike per any time window we choose to measure. This simply means the minimum mass above zero simply is one counter-strike between two indivisible particles.

[b] The mass gap could be less than one counter-strike per second; the mass gap is 1 counter-strike per any time window we choose to measure. This simply means the minimum mass above zero simply is one counter-strike between two indivisible particles.

5 The Reduced Planck Constant and Alternative Redefinitions of the Kg

By defining a kg as an integer number of counter-strikes per second we can get an exactly defined kg measure and also an exactly defined Planck constant. We could define one kg as an exact number of counter-strikes, for example

$$\text{One kg in terms of counter-strikes per second} = 8.52246550435748 \times 10^{50} \tag{15}$$

We could call $852246550435748 \times 10^{36}$ the one kg constant. The redefined reduced Planck constant would then be defined as exactly

$$\hbar = \frac{c^2}{852246550435748 \times 10^{36}} = \frac{299792458^2}{852246550435748 \times 10^{36}} \tag{16}$$

Actually, a better standard would likely be to define the kg as an exact number of Planck masses for one Planck second, something we will quickly look at next.

Re-defining the kg as an exact number of Planck masses?

An interesting alternative would be to redefine the kg as an exact number of Planck masses. This NIST (2014) CODATA reports a Planck mass of 2.1764×10^{-8} kg with a standard uncertainty of 0.000051×10^{-8} kg. This means with about 95% probability that one kg consists of between

$$\frac{1 \text{ kg}}{2.1764 \times 10^{-8} + 2 \times 0.000051 \times 10^{-8} \text{ kg}} \approx 45943805.21$$

and

$$\frac{1 \text{ kg}}{2.1764 \times 10^{-8} - 2 \times 0.000051 \times 10^{-8} \text{ kg}} \approx 45948111.72$$

Planck masses. Again, we could define the kg as an exact amount of Planck masses. For example, we could define the kg as exactly 46,000,000 Planck masses. No matter the number of Planck masses, this definition would naturally give a relative standard uncertainty in the kg equal to the relative standard uncertainty in the Planck mass, that is a relative standard uncertainty of 2.3×10^{-5}. However, the number of Planck masses in a kg would be exactly defined. This alternative kg definition could possibly be give further insight in mass standards, and is particular interesting with respect to Haug's recent development in understanding Heisenberg's uncertainty principle relation to the Planck mass.

Most physicists think the Planck mass only can be found if we already know Newton's gravitational constant. In 1899, Max Planck [13, 14] gave the formula $m_p = \sqrt{\frac{\hbar c}{G}}$. Recent research, however, shows that the Planck mass can be measured directly without any knowledge of Newton's gravitational constant as described by Haug [17, 18]. As also shown by Haug, the standard error in the Planck mass will always be exactly half of that of measurement error in the gravitational constant. This would give considerably uncertainty in such things as a redefined kg, since there is considerably standard uncertainty in the Planck mass. Even so, a redefinition of the kg could still be very useful.

6 Two Faces of the Mass Gap

Haug [2, 19, 20, 21] has recently introduced a new maximum velocity for subatomic particles (anything with rest-mass) that is just below the speed of light given by

$$v_{max} = c\sqrt{1 - \frac{l_p^2}{\bar{\lambda}^2}} \tag{17}$$

where $\bar{\lambda}$ is the reduced Compton wavelength of the particle we are trying to accelerate and l_p is the Planck length. To observe a photon, for example, we claim the photon has to interact with something. If we want to observe a single photon within one second, then we will claim we need a collision between two photons (that is two indivisible particles). This means the two indivisible particles moving towards each other can be seen as a mass with reduced Compton wavelength equal to $\bar{\lambda}_g$ if they have one collision within one second. And only if there is at least one collision in observed time- window will we have a mass gap. This means the maximum velocity of two photons that we actually observe within one second is

$$\begin{aligned} v_{max,g} &= c\sqrt{1-\frac{l_p^2}{\bar{\lambda}_g^2}} \\ &\approx c \times 0.99999999999999999999999999999999999999 \\ &\quad 999999999999999999999999999999999999999999999999855 \end{aligned} \tag{18}$$

That it is slightly below c and has to do with the fact that the two photons collided and that the collision lasted for one Planck second. So the speed of light is naturally still c, the point is that for an instant (one Planck second), the two light particles form a Planck mass. Interestingly, the relativistic mass of the mass gap is the Planck mass

$$m_p = \frac{m_g}{\sqrt{1-\frac{v_{max,g}^2}{c^2}}} = m_g\frac{\bar{\lambda}_g}{l_p} = \frac{\hbar}{\bar{\lambda}_g}\frac{1}{c}\frac{\bar{\lambda}_g}{l_p} = \frac{\hbar}{l_p}\frac{1}{c} \tag{19}$$

This also means that the rest-mass of a Planck mass particle (which is equal in value to the Planck mass times the Planck time) is

$$m_g = m_p\sqrt{1-\frac{v_{max,g}^2}{c^2}} \tag{20}$$

If we observe one photon to photon collision in one second, then each indivisible particle (photon) has a relativistic mass equal to half of the Planck mass. At the very instant when two light particles collide we can consider the velocity to be zero. Even if a single indivisible particle has a relativistic mass equal to half of the Planck mass, its rest-mass is just equal to half of the mass gap. However, the mass gap always consists of two indivisible particles colliding and is m_p if observed in one Planck second and 1.17337×10^{-51} kg if it is observed in a one second time window.

This means the photon has rest-mass, the rest-mass of a single photon (indivisible) particle is $\frac{1.17337\times10^{-51}}{2}$ kg. However, this rest-mass can never be observed alone, but can only be observed when the photon collides with another indivisible particle. Both make up $\frac{1.17337\times10^{-51}}{2}$ kg of the potential observable rest-mass. This means the smallest mass we can observe within a second above zero is 1.17337×10^{-51} kg.

We can say each photon (that is each indivisible particle) has a relativistic potential mass of half the Planck mass, but a rest-mass of half the mass gap. The relativistic mass of a photon is different than the relativistic mass of any other particle. The relativistic mass of the photon is a mass than never comes into play, so we could just as well claim it has no relativistic mass. For all practical purposes photons have no relativistic mass, but only rest-mass. And they only have this rest-mass at counter-strike with other particles. Their minimum rest-mass is $\frac{1.17337\times10^{-51}}{2}$ kg per second in the observational window and m_p for a one Planck second observational window.

In this regard, we think modern physics has missed an important insight. The photon has rest-mass at collision lasting for an instant, but no relativistic mass. However, a relatively stable system of two or more indivisible particles going back and forth counter-striking will also have a relativistic mass when viewed as an “object“ moving relative to the observer frame.

7 Time Dependent Mass Gap Implications: The Possibility of the EmDrive?

If the mass gap is dependent on the observational time window, then this has implications for how we look at mass and energy. This might explain why the so-called EmDrive (RF resonant cavity thruster) seems to works. The cone shape of the EmDrive will make free indivisible particles counters-strike more frequently in the narrow end than they do in the wide end. At each strike, an indivisible particle has a rest-mass of

$\frac{1.17337\times 10^{-51}}{2}$ kg and also an energy of $\frac{1}{2}m_g c^2 = \frac{1}{2}\frac{\hbar}{\bar{\lambda}_g}\frac{1}{c}c^2 \approx 5.27286\times 10^{-35}$J (or 3.29×10^{-16} eV).[2] What modern physics calls a single photon is, under atomism, actually minimum two indivisible particles traveling after each other with void-space between them so we can observe a frequency (much like what has been suggested by Newton). The so-called wavelength is the void-space distance between each indivisible particle in the photon, although that is not so important in this discussion. What is important is that indivisible particles that the photon consists of when they are not trapped in a stable counter-strike pattern (stable matter, matter that last considerably longer than a Planck second) will have an observable energy that is dependent on number of counter-strikes, and the number of counter-strikes is dependent on the time window. The time window can be manipulated by setting up "mirrors" with different distances between them.

The EM cone drive can possibly be seen as a series of light-clocks lying next to each other. At the narrow end of the cone is a clock ticking frequently (the indivisible particles are bouncing more often back and forth there), while at the wide end the clock is ticking more slowly. Each tick in the clock has a force of 5.27286×10^{-35}J .

The EmDrive is likely to come into conflict with energy mass conservation in the way modern physics looks at energy and matter. Under modern physics we do not know much about the mass gap, nor do we have a theory that shows the mass gap is dependent on the time window. This means the energy in a beam of light hitting a surface and bouncing off is following the rules of modern physics, while a beam that is bouncing back and forth between some mirrors may not be that well understood.

The EmDrive does not seem to be in conflict with atomism, but rather is consistent with what one could expect from atomism. However, we are assuming that the walls in the EmDrive cone are "rigid" and not deformed by the counter-strikes from the indivisibles hitting them. The walls are part of a complex system containing an enormous number of subatomic particles, that consist of indivisible particles trapped in relatively stable systems, moving back and forth counter-striking with each other. There could be additional factors that need to be taken into account. We do not blindly endorse the EmDrive, but think it could be interesting to see it in the context of atomism.

8 The Gravity Gap

We suspect our theory of the mass gap (that must be seen in connection to Haug's other work on atomism) also gives us what we can call the gravity gap. The gravity gap is the smallest amount of gravity we can hypothetically observe above zero, even with the finest possible instruments of the future. The gravity gap is linked to the rest-mass of the indivisible particles. As with the mass gap, the time window for the gravity gap is important. To obtain the gravity gap for an observational time period of one second we will use Newton's gravitational formula and get

$$F = G\frac{mm}{r^2} = G\frac{m_p m_p}{r_c^2} \approx 3.51767\times 10^{-43}\text{ N} \tag{21}$$

where m_p is the Planck mass and r_c is a radius equal to how far the light (and gravity) can travel in one second, that is $r_c = 299792458$ meter. Haug [20, 23, 24] has recently suggested that big G is a universal composite constant that can be written in the form

$$G = \frac{l_p^2 c^3}{\hbar} \tag{22}$$

This is also consistent with the McCulloch Heisenberg-derived Newton equivalent gravitational constant; see [15, 16]. This formula 22 can naturally be found by simply rewriting the Planck length formula with respect to big G. However, Haug [20] has also derived this formula from dimensional analysis as well as from Heisenberg's uncertainty principle, using his newly-introduced maximum velocity formula for matter [25]. The rewritten form of big G gives us the gravity gap from more fundamental units

$$F_g = \frac{l_p^2 c^3}{\hbar}\frac{\frac{\hbar}{l_p}\frac{1}{c}\frac{\hbar}{l_p}\frac{1}{c}}{r_c^2} = \frac{\hbar c}{r_c^2} \approx 3.51767\times 10^{-43}\text{ N} \tag{23}$$

The gravity gap for one Planck second observational time window should be related to the mass gap we have for one Planck second.

[2] In value terms this is simply equal to $\frac{1}{2}\hbar$.

$$F_g = G\frac{mm}{r^2} = G\frac{m_p m_p}{l_p^2} \approx 1.21034 \times 10^{44} \text{ N} \tag{24}$$

Unlike the mass gap, we claim that the gravity gap is linked to probability where the gravitational coupling factor $\frac{l_p^2}{\bar{\lambda}^2}$ is a conditional probability as suggested by [26]. In the special case of electrons we have $\bar{\lambda} = \bar{\lambda}_e$ and then $\frac{l_p^2}{\bar{\lambda}_e^2}$ is the dimensionless gravitational coupling constant. We think it is better to call it a dimensionless gravitational coupling factor (or a quantum gravity probability factor), since the reduced Compton length is different for different fundamental particles.. At the subatomic level we think gravity is linked to conditional probabilities of gravity shielding. So this is the gravitational gap we will get on average measurements from a tremendous number of observations of the gravity shielding between two indivisible particles. Personally we do not think this gravity gap ever can be measured due to technical difficulties, but we think it could take us further in unifying gravity with the quantum world. Possibly we may be able to measure it indirectly and find that this is likely the gravity gap.

9 Summary

We have suggested that the mass gap is 1.17337×10^{-51} kg per second observational period, or $\frac{1}{852246550435748 \times 10^{36}}$ fraction of the number of counter-strikes of one kg. In the atomism model, the mass gap is one single counter-strike between two indivisible particles. The mass gap can also conceptually be seen as a subatomic particle with a reduced Compton wavelength equal to the distance light travels in one second if we are interested in the mass gap for a one-second time period.

Further, based on this perspective, one kg of mass can be redefined as $852246550435748 \times 10^{36}$ counter-strikes between indivisible particles per second. This leads us to a redefinition of the reduced Planck constant, which can be represented as $\hbar = \frac{c^2}{8.52246550435748 \times 10^{50}}$. And every type of fundamental particle can be represented as a fraction of the number of counter-strikes in one kg. That is to say, any mass is given as a particle frequency divided by the number of counter-strikes in one kg.

$$m = \frac{c}{\bar{\lambda}} \frac{1}{852246550435748 \times 10^{36}} \text{ counter-strike fraction of one kg} \tag{25}$$

Further, the mass gap for one Planck second is one Planck mass. One kg has approximately 45,945,119 counter-strikes per Planck second. This means that the minimum mass one can observe in one Planck second as a fraction of the counter-strikes in one kg is $\approx \frac{1}{45945119} \approx 2.17651 \times 10^{-08}$, which is the Planck mass.

We think that our theory could be useful for better understanding the kilogram and thereby also the Planck constant. The speed of light is already exactly defined, so is one meter, and here the Planck constant and the kilogram could be as well. The uncertainty in many measurements would then lie in how long a second actually is. More importantly, if one studies Haug's full theory on atomism, then one may see that many of the central mysteries in physics can be reduced to very simple logic. It is clear that the Planck constant and the gravitational constant are composite constants. When decomposing these constants into what they may truly represent, we are able to develop very simple and logical explanations for mass, energy, time, and much more. Further, we will claim that the photon has rest-mass at collision lasting for a Planck second, but no relativistic mass. The time dependent mass gap seems to be a possible explanation for why the EmDrive could work, but this need further investigation. I encourage people interested in this perspective to read my full theory on atomism to better grasp this paper.

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