Natural Units' Collision Space-Time
Maximum Simplified Theory that Fits Observations

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Abstract

We have recently [1, 2] shown a possible method to unify gravity and quantum mechanics in a simple way that we have called collision space-time. Here, we demonstrate a special version of our theory when we set $l_p = 1$ and $c = 1$. Mass, energy, Compton momentum, and the Schwarzschild radius are then all identical, and simply a collision frequency. A frequency below one is not observable and can be interpreted as a frequency quantum probability. One could easily make the mistake that this is simply setting $G = \hbar = c = 1$ (Planck natural unit system); however this would possibly be inaccurate as we do not need either G or $\hbar$ in our system even when not setting them to one. Furthermore, we can find the Planck length totally independent of G and $\hbar$, for any standardised length unit chosen. Setting $c = 1$ simply means one links space and time through the speed of light, and setting $l_p = 1$ means one selects the Planck length as the fundamental length unit, and the Planck length we have argued for is the diameter of an indivisible particle.

One of the beauties of our theory is that, in the output of many formulas we obtain from our theory, the integer part represents real observations (collisions) and fractions represent quantum probabilities. Therefore, we could say there is also almost a unification between numbers and physics, not only a unification of gravity and quantum mechanics.

Keywords: gravity, quantum mechanics, mass, energy, momentum, Schwarzschild radius, natural units.

1 Our theory

As we have shown in a series of papers, the Planck length can be found independent of any knowledge of G [3] and without any knowledge of G and $\hbar$ [2, 4] and also without any knowledge of G, c or $\hbar$ [5]. Similar methods can be used to find l_p first and next set $l_p = 1$; this step seems to be needed to calibrate the model for any practical use. The only constant we end up with is therefore 1 ($l_p = c = 1$); that is to say, 1 is very special, it represents an observable event. If our theory is not studied carefully, one could mistake it as simply setting $G = \hbar = c = 1$. This would also be a mistake, we are indeed setting $c = 1$ based on logical reasoning (which we will come back to later), but our theory is totally independent of the universal composite constants of G and $\hbar$. G and $\hbar$ contain human inventions linked to an arbitrary clump of matter called the kilogram (kg), that the fundament of the universe does not care about – to incorporate this would mean a unnecessarily complex theory. The main point is not that we get a constant free theory, we still have two constants, the Planck length and the speed of light, but that we set them to 1. The key factor is to re-write the theory to see how simple physics really can be. And, importantly, we are also able to unify gravity with quantum mechanics.

We are here primarily summarising the mathematical results of our theory. For a discussion on the interpretation we recommend our other papers mentioned above.

2 Energy, mass and momentum and half the Schwarzschild radius are all identical

First, we link length to time through the speed of light, so we can set $c = 1$, see also [6]. However, we do not need to set $\hbar$ and G to one also, as we do not even need these two constants, see [1, 2]. In our theory, we are able to replace $\hbar$, G and c with only l_p and c, i.e., our theory needs two universal constants compared to the standard theory that needs three. Well, one can, in addition, naturally discuss the possibility that we need more than that, as both the standard theory and our theory also need the fine structure constant to describe some electromagnetic phenomena.

At the deepest level energy, mass, momentum and half the Schwarzschild radius are all the same, they are all given by

$$\bar{m} = \bar{E} = \bar{p}_t = \bar{R}_s = l_p \frac{l_p}{\bar{\lambda}}\gamma = l_p \frac{l_p}{\bar{\lambda}\sqrt{1-v^2}} \quad (1)$$

where $\gamma = \frac{1}{\sqrt{1-v^2}}$, and $\bar{R}_s$ is half the relativistic Schwarzschild radius ($\bar{R}_s = \frac{1}{2} r_s \gamma$), and $\bar{m}$ is the collision time mass, and $\bar{E}$ is the collision length energy, and $\bar{p}$ is the total Compton momentum – interested readers can find out more in my previous papers referred to above. Furthermore, $\bar{\lambda}$ is the reduced Compton wavelength of the mass in question, and v is the velocity of the mass in question. The maximum velocity of elementary particle is now given by

$$v_{max} = c\sqrt{1 - \frac{l_p^2}{\bar{\lambda}^2}} = \sqrt{1 - \frac{l_p^2}{\bar{\lambda}^2}} \quad (2)$$

given that we have $c = 1$, and, in addition, the reduced Compton wavelength cannot contract to shorter than the Planck length, as discussed in great detail in [2]. The part $\frac{l_p}{\bar{\lambda}\sqrt{1-v^2}}$ is, for masses, smaller than the Planck mass, a quantum frequency probability when the observational time window is the Planck time. For masses larger than the Planck mass the integer part then represents the number of collisions per Planck time, and the remaining part is a quantum probability for one more collision to be observed in a Planck time.

This means the maximum mass, energy and Compton momentum for an elementary particle is one, which is a Planck mass or a Planck mass particle; that is to say after we have calibrated $l_p = 1$ first.

Table one summarises many fundamental entities; pay attention to the fact that mass, energy, Compton momentum and half the relativistic Schwarzschild radius are all mathematically identical. Moreover, the standard momentum, also when re-written to its simpler form, is never needed, it is a derivative of the Compton momentum that again is the energy, or the mass of the particle in question. To go from formula 1 to the standard kg mass we need to multiply by $\frac{\hbar}{l_p^2}$ see [1]. One is, in standard physics, using two different mass definitions without knowing it; one is using the standard kg mass, that can be expressed through universal constants as

$$m = \frac{\hbar}{\bar{\lambda}} \frac{1}{c} \quad (3)$$

where $\bar{\lambda}$ is the reduced Compton wavelength [7]. This kg mass formula we obtain from simply solving the Compton wavelength formula with respect to m. However, in all observational gravitational phenomena, we have GM. The gravity constant is actually needed to convert the incomplete kg mass into a more complete mass definition that we call collision time. To see this we first need to realise that the gravity constant G is a composite constant [8] in the form of $G = \frac{l_p^2 c^3}{\hbar}$. This is simply the Planck [9] length formula $l_p = \sqrt{\frac{G\hbar}{c^3}}$, solved with respect to G. In standard physics one would think this would only lead to a circular problem as it is assumed one needs to know l_p to find G, however this we have demonstrated is not the case [4, 10]. This means we have

$$GM = \frac{l_p^2 c^3}{\hbar} \frac{\hbar}{\bar{\lambda}} \frac{1}{c} = c^3 \frac{l_p}{\bar{\lambda}} \frac{1}{c} \quad (4)$$

where the part $\frac{l_p}{\bar{\lambda}} \frac{1}{c}$ is the collision time mass definition. That is to say, G is needed to get $\hbar$ out of the kg mass and the Planck length into the mass, which is necessary in order to be able to perform any gravity prediction.

Rest mass energy	$\bar{E} = \frac{1}{\bar{\lambda}}$
Total energy	$\bar{E} = \frac{1}{\bar{\lambda}_M}\gamma = \frac{1}{\bar{\lambda}\sqrt{1-v^2}}$
Kinetic energy	$\bar{E}_k = \frac{1}{\bar{\lambda}_M\sqrt{1-v^2}} - \frac{1}{\bar{\lambda}}$
Kinetic energy when $v << c$	$\bar{E}_k \approx \frac{1}{2}\frac{v^2}{\bar{\lambda}}$
Rest mass	$\bar{m} = \frac{1}{\bar{\lambda}}$
Relativistic mass	$\bar{m} = \frac{1}{\bar{\lambda}}\gamma = \frac{1}{\bar{\lambda}\sqrt{1-v^2}}$
Kinetic mass	$\bar{m}_k = \frac{1}{\bar{\lambda}\sqrt{1-v^2}} - \frac{1}{\bar{\lambda}}$
Kinetic mass when $v << c$	$\bar{m}_k \approx \frac{1}{2}\frac{1}{\bar{\lambda}}v^2$
Rest Compton momentum	$\bar{p}_t = \frac{1}{\bar{\lambda}}$
Compton momentum (total)	$\bar{p}_t = \bar{m} = \frac{1}{\bar{\lambda}}\gamma = \frac{1}{\bar{\lambda}\sqrt{1-v^2}}$
Kinetic Compton momentum	$\bar{p}_k = \frac{1}{\bar{\lambda}_M\sqrt{1-v^2}} - \frac{1}{\bar{\lambda}}$
Kinetic Compton momentum when $v << c$	$\bar{p}_k \approx \frac{1}{2}\frac{1}{\bar{\lambda}}v^2$
Rest Schwarzschild radius (half)	$\frac{1}{2}r_s = \frac{1}{\bar{\lambda}}$
Relativistic Schwarzschild radius (half)	$\frac{1}{2}r_{s,r} = \bar{r}_s = \bar{m} = \frac{1}{\bar{\lambda}}\gamma = \frac{1}{\bar{\lambda}\sqrt{1-v^2}}$
Kinetic Schwarzschild radius	$1/2r_{s,k} = \bar{r}_{s,k} = \frac{1}{\bar{\lambda}_M\sqrt{1-v^2}} - \frac{1}{\bar{\lambda}}$
Kinetic Schwarzschild radius when $v << c$	$1/2r_k = \bar{r}_k \approx \frac{1}{2}\frac{v^2}{\bar{\lambda}}$
Energy Schwarzschild radius (half)	$\bar{E} = \bar{r}_{s,r}$
Rest mass collision frequency probability	$P = \frac{1}{\bar{\lambda}}$
Relativistic frequency probability	$P = \frac{1}{\bar{\lambda}}\gamma = \frac{1}{\bar{\lambda}\sqrt{1-v^2}} \leq 1$
Kinetic probability	$P_k = \frac{1}{\bar{\lambda}_M\sqrt{1-v^2}} - \frac{1}{\bar{\lambda}}$
Rest mass non-collision frequency probability	$P_n = 1 - \frac{1}{\bar{\lambda}}$

Velocity limit	$0 \leq v \leq \sqrt{1 - \frac{1}{\bar{\lambda}^2}}$
"Lorentz" factor	$\gamma = \frac{1}{\sqrt{1-v^2}}$
"Max" Lorentz factor	$\gamma_{max} = \frac{1}{\sqrt{1-v_{max}^2}} = 1$
Relativistic energy mass relation	$\bar{E} = \bar{m}$
Relativistic energy mass relation	$\bar{E} = \bar{m}_k + \bar{m}$
Relativistic energy Compton momentum relation	$\bar{E} = \bar{p}_t$
Relativistic energy Compton momentum relation	$\bar{E} = \bar{p}_k + \bar{p}_r$
Relativistic energy Schwarzschild relation	$\bar{E} = \frac{1}{2}r_{s,r}$
Relativistic energy Schwarzschild relation	$\bar{E} = \frac{1}{2}r_{s,r} + \frac{1}{2}r_s$
Uncertainty relation	$\Delta\bar{p}_t\Delta x > 1$
Uncertainty relation	$\frac{1}{\bar{\lambda}} \leq \frac{1}{\bar{\lambda}\sqrt{1-\Delta v}} \leq 1$
Relativistic quantum wave equation 1	$\nabla_t\psi = \nabla\psi$
Relativistic quantum wave equation 2	$\nabla_t\Psi = \nabla\Psi - \frac{1}{i\bar{\lambda}}$
Space-time geometry	$dx^2 + dy^2 + dz^2 = dt_x^2 + dt_y^2 + dt_z^2$
Never needed	
de Broglie Momentum	$p = \frac{v}{\bar{\lambda}_b\sqrt{1-v^2}}$
Momentum when $v << c$	$p = \frac{v}{\bar{\lambda}_b}$
de Broglie wavelength	$\bar{\lambda}_b = \frac{v}{p\sqrt{1-v^2}}$
Relativistic energy momentum relation	$\bar{E}^2 = p^2 + \bar{m}^2$

Table 1: The table shows formulas for energy, mass, momentum, the Schwarzschild radius and a frequency probability. These are all the same, as they can only be seen from this deepest level of physics. It is not possible to make a deeper theory than this. This is the very bottom of the rabbit hole. $\bar{\lambda}$ is the reduced Compton wavelength, this can be found for any mass, see [2, 7, 11].

3 Gravity and Calibration of Our Model

We cannot simply set $l_p = 1$. We must first choose a different length unit that we can observe, then find out how long the Planck length is relative to this unit. Next, we can convert the length unit we started with to the number of Planck lengths and then set $l_p = 1$. We cannot see that this has previously been discussed in the physics literature. If someone claims one can simply set $l_p = 1$ without finding l_p relative to a chosen observable length unit first, then we would be happy to see this demonstrated, but we think it is perhaps impossible. The same formulas that we have found can be obtained without using this step (calibration method), but then the formulas cannot be used to predict anything as one would not know the number of Planck length units in such variables as R, the Compton wavelength, etc.

We will rely on Newton's [12] original gravitational force formula (that he only stated in words); it is equivalent to

$$F = \frac{\bar{M}\bar{m}}{R^2} \tag{5}$$

and not the [13] 1873 version of the formula $F = G\frac{Mm}{R^2}$, that came into being about the same time as the kg definition of mass became widespread in Europe, see also [14] .

But how do we calibrate our model? We first have to decide upon a length measure. We could take a piece of wood and say that was our length unit, we could say the distance from the Earth to the Moon was our length unit. What is important is that the length unit is large enough that we can observe it directly. This is only initially to ensure a starting point in our calibration. The gravitational deflection is given by [2]

$$\delta = \frac{4}{R}\frac{l_p^2}{\bar{\lambda}_M} \tag{6}$$

. We will use this to find the Planck length relative to our initially chosen length unit. Assume we decide to initially use the metre as length unit. We now need R and $\bar{\lambda}$ and δ to find l_p. Assume we have been able to find the distance to the Sun by parallax or alternatively by the method first suggested by Halley [15], that Newton possibly used. The distance to the Sun is given as 696,340,000 metres. So we have decided upon using metres here initially. We also need the reduced Compton wavelength of the Sun. We start out by finding the Compton wavelength of the electron; it is given by

$$\lambda_e = \frac{\lambda_2 - \lambda_1}{1 - \cos\theta} \tag{7}$$

where θ is the scattering angle, and λ_1 and λ_2 are the ingoing and outgoing photon wavelengths. Furthermore, the cyclotron frequency is given by

$$\omega = \frac{v}{r} = \frac{qB}{m} \tag{8}$$

Protons and electrons have the same charge, so the cyclotron ratio is equal to the mass ratio, that again is equal to the Compton wavelength ratio.

$$\frac{\omega_P}{\omega_e} = \frac{\bar{\lambda}_e}{\bar{\lambda}_P} \approx 1836.15 \tag{9}$$

So we now know the proton wavelength, which is given by $\bar{\lambda}_P \approx \frac{\bar{\lambda}_e}{1836.15}$. Next, we can count the number of protons in the Sun, then we would know the Compton wavelength of the Sun. This is not practically possible, but we have, for example, the following relation

$$\frac{\bar{M}_1}{\bar{M}_2} = \frac{\bar{\lambda}_2}{\bar{\lambda}_1} = \frac{R_1^3 T_2^2}{R_2^3 T_1^2} \tag{10}$$

Assume we find the orbital time of the small sphere around the large sphere in a Cavendish apparatus; it is given by

$$T_1 = \frac{\sqrt{\frac{L4\pi^2\theta R_1}{T}}}{2\pi R_1} \tag{11}$$

Pay attention to the fact that we do not need to know G, $\hbar$. From this we find the Compton wavelength of the Sun, it is approximately $\bar{\lambda} = 1.77 \times 10^{-73}\ m$. Now we have all we need to find the Planck length from formula 6, we get

$$l_p = \sqrt{\frac{\delta R\bar{\lambda}_M}{4}} \approx 1.61 \times 10^{-35}\ \text{m} \tag{12}$$

Next we can find how many Planck lengths there are in one metre, namely $\frac{1}{1.61\times10^{-35}} \approx 6.18 \times 10^{34}$, next we set $l_p = 1$ and we can now use all the formulas in Tables 1, 2 and 3.

Rest Mass Energy	$\bar{E}=\frac{1}{\bar{\lambda}_M}$
Rest Mass	$\bar{M}=\frac{1}{\bar{\lambda}_M}$
Gravity force (from mass)	$F=\frac{\bar{M}\bar{m}}{R^2}$
Gravity force (from energy)	$F=\frac{\bar{E}\bar{e}}{R^2}$
Gravity force (from half Schwarzschild)	$F=\frac{\bar{R}_s\bar{r}_s}{R^2}$
Gravity acceleration	$g=\frac{1}{R^2}\frac{1}{\bar{\lambda}_M}$
Orbital velocity	$v_o=\sqrt{\frac{1}{R\bar{\lambda}_M}}$
Orbital time	$T=2\pi\sqrt{\bar{\lambda}R^3}$
Velocity ball Newton cradle	$v_{out}=\frac{1}{R}\sqrt{\frac{H}{\bar{\lambda}}}$
Periodicity Pendulum (clock)	$T=2\pi R\sqrt{L\bar{\lambda}}$
Frequency Newton spring	$f=\frac{1}{2\pi R}\sqrt{\frac{1}{\bar{\lambda}x}}$
Gravitational red-shift	$z\approx\frac{\sqrt{1-\frac{2}{R_1\bar{\lambda}_M}+\frac{1}{R_1^2\bar{\lambda}_M^2}}}{\sqrt{1-\frac{2}{R_2\bar{\lambda}_M}+\frac{1}{R_2^2\bar{\lambda}_M^2}}}-1$
Time dilation	$T_R\approx T_f\sqrt{1-\frac{2}{R\bar{\lambda}_M}+\frac{1}{R_2^2\bar{\lambda}_M^2}}$
Gravitational deflection (GR)	$\delta=\frac{4}{R}\frac{1}{\bar{\lambda}_M}$
Advance of perihelion	$\sigma=\frac{6\pi}{a(1-e^2)}\frac{1}{\bar{\lambda}_M}$
Microlensing	$\theta_E=2\sqrt{\frac{d_S-d_L}{\bar{\lambda}_M(d_Sd_L)}}$
Escape velocity	$v_e\approx\sqrt{\frac{2}{R\bar{\lambda}_M}}$
Escape velocity	$v_e=\sqrt{\frac{2}{R\bar{\lambda}_M}-\frac{1}{\bar{\lambda}_M^2R^2}}$
Escape velocity	$v_e=\sqrt{\frac{r_s}{R}-\frac{r_s^2}{4R^2}}$
Schwarzschild radius	$r_s=\frac{2}{\bar{\lambda}_M}$
Schwarzschild reduced Compton relation	$r_s\bar{\lambda}=2$
Planck length	$l_p=\sqrt{\frac{1}{2}r_s\bar{\lambda}}=1$
Gravitational parameter	$\mu=\frac{1}{\bar{\lambda}_M}$
Two body problem	$\mu=\frac{1}{\bar{\lambda}_1}+\frac{1}{\bar{\lambda}_2}$

Table 2: The table shows a constant free gravity

The Newtonian theory does not work to predict supernova data, for this we need relativistic modifications, and we get the formulas in Table 3, see [16] for how we also can use the 1873 formula to predict supernovas without dark energy.

Energy	$\bar{E}=\frac{1}{\bar{\lambda}_M}\gamma$
Mass	$\bar{M}=\frac{1}{\bar{\lambda}_M}\gamma$
Relativistic force	$F=\frac{\bar{M}\gamma_M\bar{m}\gamma_m}{R^2 1/\gamma_M^2}$

Table 3: The table shows a constant free relativistic gravity; the constant is 1, it fits supernova data well with no need for the dark energy hypothesis. [16].

4 Conclusion

We have proposed a theory that unifies gravity and quantum mechanics, one which has two constants; the speed of light and the Planck length. In this paper, our focus is on the idea that, when we set these two universal constants to $c=l_p=1$, we get an even simpler theory, also in this case there is no need for G and $\hbar$. One of the main conclusions is that mass, energy, Compton momentum and the Schwarzschild radius are all ultimately the same. The reason we use all these entities is rooted in the idea that we have linked several parts of modern physics to human constructs, such as an arbitrary clump of matter that we call a kilo, and also that we have not before recently understood that the standard momentum is a derivative of the Compton momentum, etc. The laws of the universe do not care about human inventions, and to try to enforce human inventions on a model describing reality only makes the theory unnecessarily complex. The standard theory is unnecessarily complex and at the same time incomplete, but our theory is both more complete and much simpler.

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