The Collision Time of the Observable Universe is 13.8 Billion Years per Planck time: A New Understanding of the Cosmos based on Collision Space-Time

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Abstract

We have recently presented a model that seems to allow us to unify gravity with quantum mechanics in a simple and logical way. We have called this theory collision space time. In previous papers, we have not looked at the Hubble constant or what we can call the Hubble scale of the universe. However, our theory seems to predict that the universe did not start with the Big Bang, but that it has always existed and always will exist, being infinite in space and time. This was thought to be the case before the discovery of the cosmological redshift and the Hubble constant. There is no doubt in our view that the Hubble "law", a linear relation between redshift and distance in our observable universe has been observed. The question is whether we currently have the correct interpretation.

In this paper, we show that that the collision time of a mass inside a sphere with an escape velocity equal to c and with a density equal to the critical mass density of the observable universe is approximately 13.8 billion years. This has nothing to do with the age of the universe. It is simply an aggregated time for the collision times of the fundamental particles inside the Hubble sphere during a Planck time window. The Hubble radius is identical to the corrected Schwarzschild radius after taking into account relativistic mass. This means that the Big Bang never happened. Also, the Hubble radius is identical to what we can call the relativistic corrected Schwarzschild radius. Our model gives a completely new view on cosmology where the 13.8 billion years of collision time are directly linked to the subatomic world.

Keywords: Hubble constant, corrected Schwarzschild radius, Hubble radius, Collision-time Schwarzschild sphere.

1 Introduction

We [1, 2] have recently introduced a model that unifies quantum gravity and quantum mechanics and strongly recommend these papers are studied first, in particular, the second paper that is an improvement on the first paper on our theory. Our model leads to a long series of simplifications both mathematically and in terms of logical consistency. For example, we have shown that the momentum, as well as the relativistic energy momentum relation are just derivatives of a deeper and much simpler reality. We have shown that the Compton wavelength is likely the true matter wavelength and that the de Broglie wavelength is also just a derivative of this, which leads to strong simplifications and removes a series of almost absurd interpretations. In particular, we have shown that the current kg mass is an incomplete mass definition, but that when embedded in gravity, it is a more complete mass definition and we have called this the collision-time. The Collision-time is given by

$$\bar{M} = \frac{G}{c^3}M = \frac{l_p}{c}\frac{l_p}{\bar{\lambda}} = t_p\frac{l_p}{\bar{\lambda}} \tag{1}$$

where $\bar{\lambda}$ is the reduced Compton [3] wavelength of the mass in question. For an in-depth discussion on this, see the papers mentioned above, as well as [4]. This collision time mass is for a Planck mass particle and is Planck time. For a mass smaller than a Planck mass, it is a very small fraction of Planck time. This is not because there is any observable time interval smaller than Planck time, but because masses smaller than then Planck mass are in a non-collision state most of the time. For masses considerably larger than the Planck mass, the collision-time is an aggregate of Planck times. This simply means we have many particles making up the object. A mass with collision time of three Planck times simply means there are three collisions in an observational time window of one Planck time, each lasting for a Planck time, but inside the same Planck time interval. Again, we must refer to the papers above for an in-depth understanding and discussion of this. Here, we are focusing on whether the observed Hubble relationship (”law”) is compatible with our theory and what this means the interpretation of it is.

2 The incorrect escape velocity, Schwarzschild radius and the corrected ones

The Schwarzschild radius is simply the radius we have when a given mass is inside a radius so that the escape velocity at this radius is $v_e = c$. If the smallest length is the Planck length, then the smallest mass according to standard theory with a Schwarzschild radius is a particle that is close to the Planck mass. Actually this could be half the Planck mass, with a Schwarzschild radius equal to the Planck length. The idea of massive gravity objects where not even photon could escape was not first invented by Schwarzschild or from general relativity theory [5], but from Newton's theory. Already in 1784, John Michell [6] wrote

> *If the semi-diameter of a sphere of the same density as the Sun were to exceed that of the Sun in the proportion of 500 to 1, a body falling from an infinite height towards it would have acquired at its surface greater velocity than that of light, and consequently supposing light to be attracted by the same force in proportion to its vis inertia, with other bodies, all light emitted from such a body would be made to return towards it by its own proper gravity. This assumes that gravity influences light in the same way as massive objects.*

This radius is basically identical to the Schwarzschild radius $R_s = \frac{2GM}{c^2}$, and also the interpretation that light cannot escape is basically the same as suggested for black holes. Michell suggested dark stars. The Michell (dark star) radius was rooted in Newtonian mechanics. To find the escape velocity, here we can set the kinetic energy of the small mass to be equal to the gravitational potential energy, so we have:

$$\frac{1}{2}mv^2 - G\frac{Mm}{r} = 0 \tag{2}$$

and solving with respect to v, this gives

$$v = \sqrt{\frac{2GM}{R}} \tag{3}$$

This is called the escape velocity and the notation $v_e = v$ is often used, if we now set $v_e = c$ and solve the equation above with respect to R, we get

$$R = \frac{2GM}{c^2} \tag{4}$$

This is identical to the Schwarzschild radius, but calculated from old Newton mechanics with no reliance on general relativity theory or the Schwarzschild solution. This is no big surprise as general relativity theory gives exactly the same escape velocity [7] formula as we have derived here from simple Newton mechanics. However, when thinking in more depth about it, this seems a little strange. This because the Newton solution $E_k \approx \frac{1}{2}mv^2$ is only an approximation for kinetic energy that only holds when $v << c$, so we know the Newton solution cannot be used for finding the radius where the escape velocity is c, even if it gives exactly the same mathematical end result as the Schwarzschild solution. However, we can then ask how can the Schwarzschild solution for general relativity theory give the same solution as this Newton mechanical solution when we know the Newton solution does not hold for v close to c. We personally think the Schwarzschild solution is also invalid, not mathematically, but based on reasoning.

To incorporate Einstein's relativistic kinetic energy, the small mass in the Newton formula must also be relativistic. This brings us to a discussion on relativistic mass. Already in 1899, Lorentz [8] among others suggested that the mass of an object increased when it was moving, but that the effect was different for different directions relative to the observer. In 1903, Abraham [9] introduced the terms "*longitudinal* and *transverse* mass" for moving masses. Thomson [10] in 1904 also mentions that mass will increase as it is moving, but that this effect would be directionally dependent. The correct relativistic mass formula was actually already given by Lorentz [11] in 1904, but also he then had two formulas, one for transverse relativistic mass $m_T = m\gamma$, and one for longitudinal mass $m_L = m\gamma^3$. The Lorentz transverse moving mass formula corresponded to what today is known as relativistic mass (for any direction). Einstein likely did not know about the Lorentz 1904 paper and tried in his [12] famous 1905 paper, where he introduced special relativity theory, to derive formulas for relativistic mass, which is something he is likely to have been incorrect on. Einstein had derived the relativistic energy correctly and was the first to introduce this correctly as

$$E = mc^2\gamma \tag{5}$$

By simply dividing by c^2 on both sides, Einstein would have arrived at the correct relativistic mass. Instead, he followed the "speculative" tradition laid out before him to try to perform separate derivations of longitudinal mass and transverse mass, and in his 1905 paper on relativity theory, he gave the following relativistic mass results:

$$\text{longitudinal mass} = m\gamma^3 = \frac{m}{\sqrt{1-\frac{v^2}{c^2}}^3} \tag{6}$$

This is the same longitudinal mass that Lorentz had suggested one year before, but without reference to Lorentz, so it is likely that Einstein was not aware of the paper written by Lorentz. For transverse mass, Einstein suggested

$$\text{transverse mass} = m\gamma^2 = \frac{m}{1-\frac{v^2}{c^2}} \tag{7}$$

This is different than the Lorentz transverse mass, and it is likely to be incorrect. None of Einstein's relativistic mass formulas correspond to the well-known relativistic mass as we know it today as given by (see, for example [13, 14])

$$m_r = m\gamma = \frac{m}{\sqrt{1-\frac{v^2}{c^2}}} \tag{8}$$

This formula is used with a different notation, some uses are

$$m = m_0\gamma = \frac{m_0}{\sqrt{1-\frac{v^2}{c^2}}} \tag{9}$$

where m_0 is the rest-mass. In 1908, Lewis [15] presented the relativistic mass formula for any direction as we know it today, and is the same as the equation 9. Furthermore, in 1909, Lewis and Tolman [16] correctly derived the relativistic mass formula from mechanics. In 1912, Tolman [17] insisted that the relativistic mass given by the equation 9 was the right and relevant relativistic mass. Actually, Max Born in 1920 [18] was possibly the first person to coin the formula 9 *relativistic mass*[1]. Max Planck [20] had derived the correct relativistic momentum in 1906, $p = mv\gamma$, which is something Einstein first used in 1907. So, standard theory today typically relays on relativistic momentum instead of relativistic mass, but the relativistic momentum is simply the relativistic mass multiplied by v. Actually, the standard momentum is a derivative of the relativistic mass. Actually, the standard momentum is not valid for rest masses, see [1], and is partly why in the four-vector approach, it is replaced with rest-mass energy divided by c to get the correct fourth momentum when the mass is at rest, the so called time component. However, an in-depth discussion on this is beyond the remit of this paper.

A series of researchers have strongly criticized the use of relativistic mass as being a mathematical artifact that not should be used, see for example [21–24]. For example, Adler has claimed:

> *Anyone who has tried to teach special relativity using the four-vector space-time approach knows relativistic mass and four-vectors make for an ill-conceived marriage. In fact, most of the recent criticism of relativistic mass is presented in the context of the four-vector formulation of special relativity.*
> – Adler 1987

So, clearly relativistic mass is mainly causing interpretation challenges due to Minkowski space-time (four vector interpretation). Einstein had adopted Minkowski [25] space-time by 1922 and it seems he had abandoned the relativistic mass concept by then. Possibly, he was also possibly happy to do so too since Lorentz had the correct relativistic mass as early as 1904, one year before he published his own relativity theory. Einstein had also got the relativistic mass wrong, and other relativity theories, like that of Lorentz where still considered competitors of special relativity theory at this time. Still, it would seem a little strange that we cannot divide two sides of an equation with a constant that is already in the formula, namely to divide the relativistic mass formula of Einstein with c^2 and call it relativistic mass. Is it forbidden to divide both sides of his formula with a constant that already is there? In a letter to Lincoln Barnett, an American journalist, dated 19 June 1948, Einstein wrote,

> *It is not good to introduce the concept of the mass $M = m/\sqrt{1-\frac{v^2}{c^2}}$ of a moving body for which no clear definition can be given. It is better to introduce no other mass concept than the ?rest mass?, m. Instead of introducing M, it is better to mention the expression for the momentum and energy of a body in motion.*

This claim by Einstein has fuelled critics of the relativistic mass concept. See, for example, [23]. However, the arguments against the use of relativistic mass seem rather weak, and perhaps critics should instead take a closer look at the Minkowski space-time concept that, for example, is potentially inconsistent with quantum mechanics [26].

Actually, we think that both the abandonment of relativistic mass and the interpretation of special relativity in the form of Minkowski space-time (four vector) was a mistake that has slowed the progress in physics for

[1] See also Haug [19] that introduces kinetic mass, basically a relativistic moving mass minus the rest-mass.

many years. We have recently showed how a modified relativistic theory that can be unified with gravity theory and that quantum mechanics only is consistent with a 3-dimensional space-time (3 time-dimensions and 3 space-dimensions). Inside this framework, relativistic mass leads to no conceptual problems as presented in Minkowski space-time, but then we are also working with a more complete mass definition. We like to call this 3-dimensional space-time, as the space and time dimensions are just two faces of the same coin.

Adler in 1987 also claimed:

> *It should also be pointed out that there is no reason to introduce relativistic mass in general relativity theory.*

This view possibly explains to a greater extent why there is no relativistic mass in today's gravity theory, something we think is one of the biggest mistakes that has been made in physics. Also, prominent figures in gravity like Taylor and Wheeler [24] have been speaking out against relativistic mass. That is the more famous specialists on gravity have to a large extent ignored the investigation on what a gravity theory incorporating relativistic mass would look like in terms of predictions relative to observations. We have [27] recently shown, for example, that by introducing relativistic mass in Newtonian gravity, we can explain supernova data without the need of the dark energy hypothesis.

Other prominent physicists such as Rindler [28, 29] who have worked for much of their career with relativity theory and have defended the use of relativistic mass, criticising the critics of it, see also [30] who seem to be positive in terms of its use. Here, we will go back and claim relativistic mass is essential and a part of relativity theory. It goes hand in hand with relativistic energy. It must be introduced in all parts of physics, including gravity. We can start by deriving the relativistic escape velocity from relativistic modified Newton theory, and this must be given by solving the following equation:

$$\begin{aligned} E_k - G\frac{Mm\gamma}{R} &= 0 \\ mc^2\gamma - mc^2 - G\frac{Mm\gamma}{R} &= 0 \end{aligned} \tag{10}$$

That is, we are using Einstein's relativistic kinetic energy, but we also must ensure that the small mass is relativistic in the Newton gravity formula, that is, we need relativistic mass in gravity theory. Solved with respect to v, this gives:

$$v_e = \sqrt{\frac{2GM}{R} - \frac{G^2M^2}{c^2R^2}} \tag{11}$$

If we set $v_e = c$ and solve for R we get:

$$R = \frac{GM}{c^2} \tag{12}$$

We can call this the corrected Schwarzschild radius $R = \bar{R}_s$, or the Haug radius as we have been the first to show this derivation, see [1]. So, it is simply the radius where the velocity in kinetic energy from a small mass offsets the gravitational energy when the velocity is $v = c$. The Schwarzschild radius is double this. For example our corrected theory shows that the Planck mass has all the mathematical properties of a so-called "black-hole" at the reduced Compton wavelength of the Planck mass, while standard theory must modify the Planck mass with $\frac{1}{\sqrt{2}}$ or some other factor to get the theory consistent with that of the Planck mass, which is something special here, and has gone under the radar, see [1].

The relativistic ad-hock adjustment of the Newton formula: $F = G\frac{Mm\gamma}{R^2}$ was actually suggested in 1981 and 1986 by Bagge [31] and Phipps [32]. However, Peters [33] showed that it only predicted half of the observed Mercury precession, so the idea of using relativistic modified Newtonian mechanics was basically abandoned and not fully investigated. However, recently, Corda [34] claims that we can get the correct Mercury precession if we take the relativistic effect into account, as well as consider the Mercury and the Sun as a real two-body problem, so there is much in favour of adding relativistic masses to the Newton framework to see what it can explain. Also, as mentioned above, by adding relativistic masses in the right way means we can predict supernova data without the need for the dark energy hypothesis.

3 The mass and mass density the Observable Universe

For example, Weinberg [35] in 1972 gives[2] the critical mass density of the observable universe as

$$\rho_c = \frac{3H_o^2}{8\pi G} \tag{13}$$

[2] Page 476.

where H_o is the Hubble constant, and ρ_c is the critical mass density. The critical mass density here is when the cosmological constant Λ is set as equal to zero as it is for all basic Friedman universes [36]. This means before we can introduce such matters as dark energy. The mass in a sphere with this mass density ρ_c is then given by:

$$M_u = \rho_o V = \rho \frac{4}{3}\pi R_o^3 = \frac{3H_o^2}{8\pi G}\frac{4}{3}\pi R^3 \tag{14}$$

Furthermore, if we set the radius of the observable universe equal to the Hubble radius $R = R_o = R_h = \frac{c}{H_o}$, we can re-write and simplify the equation above as:

$$M_u = \frac{3H_o^2}{8\pi G}\frac{4}{3}\pi\left(\frac{c}{H_o}\right)^3 = \frac{1}{2}\frac{c^3}{GH_o} \tag{15}$$

This means we have half of the observable mass of the mass given by [37] and [38][3]. The 8π in the mass density formula comes from GR. We think it should be modified to only 4π if we are introducing relativistic mass, just as our Haug radius derived from taking into account relativistic mass is half the Schwarzschild radius, something we have to look closer at. So, the mass inside the Hubble sphere would indeed be $M_u = \frac{c^3}{GH_o}$, which is the same end result as suggested by, for example, [37, 38].

4 Any mass density above zero in a large area of space always has a Schwarzschild radius (sphere)

Assume a very large area of the universe, or even an infinite universe with a given average density. The mass density in the surface or centre of the Earth is clearly much higher than the mass density at the mid-point between Earth and the Moon, for example, known as outer space. However, inside an enormous space volume covering millions of galaxies, we can calculate an average density that then is basically the same if we split that large volume in two or even ten, for example. Basically, the cosmological principle; that is empirically justified on scales larger than 100 Mpc. For a given universe mass density, even if it is a very small, the mass will increase as a function of the volume we look at. If we look at the volume inside a sphere shape, the mass for a given density will increase by R^3 as we increase the radius. This is naturally because the volume of a sphere is $V = \frac{4}{3}\pi R^3$. On the other hand, the Schwarzschild radius R_s is a linear function of M, which means any large space area with a given mass density must have a Schwarzschild radius (and a Haug radius), something we will look at in detail here.

The mass of a given density for a given sphere filled with that mass density is given by:

$$M = \rho \frac{4}{3}\pi R^3 \tag{16}$$

The escape velocity for a sphere filled with a given density of mass is given by:

$$\begin{aligned} v_e &= \sqrt{\frac{2GM}{R}} \\ v_e &= \sqrt{\frac{2G\rho\frac{4}{3}\pi R^3}{R}} \end{aligned} \tag{17}$$

The escape velocity of c is the maximum escape velocity, if we set $v_e = c$, and, at the same time, keep the mass density ρ as a constant and solve this with respect to R to get the radius of a sphere with a given mass density that must be to have a Schwarzschild radius. This is given by:

$$\begin{aligned} v_e = c &= \sqrt{\frac{2G\rho\frac{4}{3}\pi R_s^3}{R_s}} \\ R_s^2 &= \frac{c^2}{2G\rho\frac{4}{3}\pi} \\ R_s &= \sqrt{\frac{c^2}{2G\rho\frac{4}{3}\pi}} \end{aligned} \tag{18}$$

If we input ρ equal to the critical mass density of the observable universe, we get:

[3]That gives $M_u = \frac{c^2 R_o}{G}$, which is equal to $M_u = \frac{c^3}{GH_o}$ since $R_o = \frac{c}{H_o}$.

$$R_s = \sqrt{\frac{c^2}{2G\frac{3H_o^2}{8\pi G}\frac{4}{3}\pi}} = \sqrt{\frac{c^2}{2H_o^2}} = 2\frac{c}{H_o} \tag{19}$$

This is the Schwarzschild radius of a universe with mass density equal to the critical mass density, which is given by twice the Hubble radius, so it seems to have nothing directly to do with the Hubble radius, but it is still strange why it would be exactly twice the Hubble radius. Bear in mind that also the Schwarzschild radius of a Planck mass is not the same as the Compton wavelength of the Planck mass, but is twice of that. However, our corrected Schwarzschild radius based on relativistic mass adjustments is $\bar{R}_s = \frac{GM}{c^2}$, so this will be identical to the Hubble radius.

$$\begin{aligned} v_e = c &= \sqrt{\frac{2GM}{R} - \frac{G^2M^2}{c^4R^2}} \\ c &= \sqrt{\frac{2G\frac{c^3}{GH_o}}{R} - \frac{G^2\left(\frac{c^3}{GH_o}\right)^2}{c^2R^2}} \\ c &= \sqrt{\frac{2c^3}{H_oR} - \frac{c^4}{R^2H_o^2}} \end{aligned} \tag{20}$$

This gives $R = \bar{R}_s = \frac{c}{H_o}$, which is the corrected Schwarzschild radius and is identical to the Hubble radius. This explains why the Hubble radius is so special. One possibly interpretation of this is that gravity ”waves” outside the Hubble radius which is identical to the corrected Schwarzschild radius, cannot affect observations (the observer point). However we will look closer at what the Schwarzschild radius and the Hubble radius represent in the following sections. This is likely to mean that the observed cosmological redshift related to Hubble is a gravitational redshift and not a velocity redshift due to the hypothetical expansion of the universe.

5 The so-called age of the universe is likely to be the aggregated collision-time of all subatomic particles in the Hubble sphere

The kg mass can be converted into the more complete mass model that is the collision-time mass. This can be carried out by simply multiplying the kg mass with $\frac{l_p^2}{\hbar}$ (be aware that we find l_p totally independent on any knowledge of G, see [4, 39]), we then end up with:

$$\bar{m} = m\frac{l_p^2}{\hbar} = \frac{\hbar}{\bar{\lambda}}\frac{1}{c}\frac{l_p^2}{\hbar} = \frac{l_p}{c}\frac{l_p}{\bar{\lambda}} = t_p\frac{l_p}{\bar{\lambda}} \tag{21}$$

The kg mass of the so-called critical mass observable universe is considered to be:

$$m = \frac{c^3}{GH_o} \approx 1.77 \times 10^{53} \tag{22}$$

This means the collision-time of that mass is:

$$\bar{T} = \bar{m} = 1.77 \times 10^{53} \times \frac{l_p^2}{\hbar} \approx 13.7 \text{ billion years} \tag{23}$$

This is the same as the assumed age of the universe. Calculation-wise, we could claim they are very similar, or some would perhaps say very different. The most important element here in our view is the dramatically different interpretation. In the standard model (Lambda-CDM), the universe started with a Big Bang approximately 13.8 billion years ago. This is based on the Hubble law, or more precisely how to explain the observed Hubble redshift.

In our model, 13.8 billion years has nothing to do with the time since the big bang. Based on our model, the big bang almost certainly never happened. The big bang theory is simply one possible way to explain the observed, but not predicted cosmological redshift. In our theory 13.8 billion years is actually an aggregated time number. The ultimate building blocks that are indivisible particles and move at the speed of light when not colliding and when colliding with each other form such a collision that lasts for the Planck time. This is not an assumption that they stand in collision at such a time interval; this is based on a calibration to gravity observations as shown in previous papers.

For example, in the simplest model, an electron consists of two indivisible particles moving back and forth over their reduced Compton wavelength, they collide every Compton time and stand still for the Planck time before again moving at the speed of light. This means that in an electron, there are the following number of collisions per second:

$$f_e = \frac{c}{\bar{\lambda}_e} \approx 7.76 \times 10^{20} \tag{24}$$

At each collision, there is a Planck mass that lasts for one Planck time, so this gives the electron mass in kg

$$m_e = f_e m_p t_p \approx 9.1 \times 10^{-31} \text{ kg} \tag{25}$$

The collision-time of the electron is:

$$\bar{m} = m_e \frac{l_p^2}{\hbar} = t_p \frac{l_p}{\bar{\lambda}_e} \tag{26}$$

This is much smaller than the Planck time as the electron (the indivisible particles inside it) is in non-collision state most of the time. For large masses such as one kg, there are an enormous number of collisions per Planck time. Its number of collisions per Planck time is:

$$\bar{m}_{1kg} = \frac{c}{\frac{\hbar}{1kg \times c}} t_p = 45994327 \text{ Planck times} = 2.48 \times 10^{-36} \text{ second} \tag{27}$$

This is the collision-time in the number of Planck times expressed as one Planck time. This means the are 45994327 collisions in one Planck time in one kg, which is equal to 2.48×10^{-36} seconds in a Planck time. This is similar for the mass inside the corrected Schwarzschild radius sphere, which is identical to the Hubble sphere. Here, the collision time per Planck time is 13.8 billion years, which corresponds to approximately 8.06×10^{51} collisions per Planck time, each lasting one Planck time inside the Hubble sphere, which is identical to the corrected Schwarzschild radius sphere. Again, in our model, we also have 13.8 billion years, but it has nothing to do with age since the big bang. It is simply an aggregate of the time of all the indivisible particles in a collision state during the Planck time window inside our corrected Schwarzschild radius sphere.

6 The Hubble constant is divided by the Collision time of the Hubble sphere

The Hubble constant is an empirical finding. It was found that most galaxies had an observed redshift that increased linearly with distance to the observer (earth). The big bang was coined by Hoyle almost as a joke for a theory (expanding universe that started out from a point). He did not like this idea, that was introduced by Hubble (working for Hoyle) and Lemaitre. The big bang theory is a rather new scientific perspective, and it should be considered carefully against other interpretations such as the one given here. For thousands of years, we have assumed the universe was infinite in space and time. The Hubble constant was not predicted by GR. It is difficult to find the exact measure of the Hubble constant as we are talking about measuring enormous cosmological distances to galaxies as accurate and also their redshift, but it is likely to be between 65 and 75 km per Mega Par second. Also, our theory has to be consistent with the Hubble constant as the cosmological red-shift law of Hubble and Lemaitre clearly have been observed and there is no doubt of that. However in our view, this is basically just a way to indirectly observe the density of matter in the universe. It is nothing more, the rest about the Hubble constant comes from our theory, or at least is fully consistent with our theory, but with a very different interpretation to standard theory.

To our great surprise the Hubble constant is identical to one divided by the collision-time mass of the Hubble sphere. So, we have:

$$H_o = \frac{1}{\bar{M}_u} = \frac{c}{\bar{R}_s} \tag{28}$$

We invented the concept of collision-time based on deep thinking about the quantum world before we even had any thoughts about whether our theory could be consistent with the Hubble constant as is evident from our papers, [1]. We can also write the Hubble constant as:

$$H_o = \frac{c}{\bar{R}_s} = \frac{c\bar{\lambda}_h}{l_p^2} \tag{29}$$

where $\bar{\lambda}_h$ is the reduced Compton wavelength of the mass in the Hubble sphere. This reduced Compton wavelength is actually the aggregate of the Compton wavelength of all the subatomic particles inside the Hubble sphere, see [4]. This also means that the collision-time mass of the Hubble sphere is given by:

$$\bar{M}_u = \frac{1}{H_o} \tag{30}$$

The SI unit of H_0 is simply s^{-1}, so this indeed gives the correct output units for the collision time mass in seconds (per Planck time). The reduced Compton wavelength of the mass inside the Hubble sphere is given by:

$$\bar{\lambda}_h = \frac{\hbar}{M_u c} = \frac{\hbar}{\frac{c^3}{GH_o} c} = \frac{\hbar G H_o}{c^4} = \frac{l_p^2 H_o}{c} = \frac{l_p^2}{\bar{M}_u c} \approx 1.98 \times 10^{-96} \text{ m} \tag{31}$$

It is much smaller than the Planck length as it is not a physical Compton wavelength, but an aggregate of the Compton wavelength of all elementary particles in the Hubble sphere. This is just as the 13.8 billion years is an aggregate of the collision times of the indivisible particles in the Hubble sphere. If we take l_p^2/c and divide this by the reduced Compton wavelength of the mass in a Hubble sphere, we get $\bar{M}_u = \frac{l_p}{c}\frac{l_p}{\bar{\lambda}} \approx 4.41 \times 10^{17}\text{s} \approx 13.8$ billion years. This because this is just the aggregate of collision times just as the Compton wavelength of the Hubble sphere is the aggregate of the reduced Compton wavelengths of the subatomic particles in that sphere. To aggregate Compton wavelengths, we need to use the following formula: $\bar{\lambda} = \frac{1}{\sum_i^n \frac{1}{\bar{\lambda}_i}}$ as discussed by Haug in several published papers [1, 4]. The Planck length is related to the Hubble radius and the reduced Compton wavelength of the Hubble sphere in the following manner:

$$l_p = \sqrt{\frac{c}{H_o}\bar{\lambda}_h} = \sqrt{R_o\bar{\lambda}_h} = \sqrt{\bar{R}_s\bar{\lambda}_h} \approx 1.61 \times 10^{-35} \text{ m} \tag{32}$$

The Hubble time is also equal to the reduced Compton frequency of the mass in the Hubble sphere multiplied by the Planck time over the Planck time. This means we have:

$$13.8 \text{ billion years} \approx \frac{c}{\bar{\lambda}_h}t_p t_p = \frac{l_p}{\bar{\lambda}_h}t_p = \bar{M}_u \tag{33}$$

To just multiply the reduced Compton frequency with the Planck time gives the collision time per second, but the second is an arbitrary human chosen time unit, and the universe only cares about the most fundamental units given by nature itself, which is Planck time. So, this is why the frequency has to be multiplied by the Planck time twice, to arrive at the collision-time in seconds per Planck time, or in years as we have given here.

The so called recessional velocity is given by:

$$v = H_o D = \frac{D}{\bar{M}_u} = \frac{D\bar{\lambda}_h c}{l_p^2} = \frac{Dc^2}{GM}c = \frac{c}{z} \tag{34}$$

where $\bar{M}_u$ is the collision-time of the mass in the Hubble sphere, this is equal to $\frac{G}{c^3}M_u$. One can question c divided by the gravitational red-shift of the mass in the Hubble sphere should be interpreted as a velocity? From this, we see that v is likely only an apparent recessional velocity, as the Cosmological redshift is unlikely to actually be cause by any expansion of the universe, and it is due to this that we are inside a Schwarzschild sphere. This is simply the distance from us to the galaxy we observe, divided by the collision-time of the mass inside the Hubble sphere. It has nothing to do with a standard velocity. Due to the fact we are inside a "Schwarzschild sphere" where the likely gravitational redshift will be affected by how close the object emitting light is to the Schwarzschild circumference as observed from our position. However, this should be investigated further. The collision distance, which is the Hubble radius divided by the collision-time mass of the mass that gave this collision length is always c. It is simply that the collision-time multiplied by c is the collision length as explained in [1, 2]. To divide any distance shorter than the corrected Schwarzschild radius by the collision-time, gives a hypothetical velocity $v < c$, but this is unlikely to be any real velocity of an object. So, the expanding universe hypothesis is likely to be incorrect in this context.

The cosmological redshift can be approximated as:

$$z \approx \frac{v}{c} = \frac{R}{\bar{M}_u c} = \frac{R}{\bar{R}_s} = \frac{R\bar{\lambda}_h}{l_p^2} = \frac{Rc^2}{GM_u} = \frac{1}{\frac{GM_u}{Rc^2}} \tag{35}$$

where $R = D$ (to make it easier to recognize that we here are working with gravitational red-shift). The cosmological red-shift is one divided by gravitational red-shift, it is a type of inverse gravitational red-shift inside the Hubble sphere(?). This means the cosmological redshift is linked to some type of gravitational redshift, so that it is linked to the velocity of galaxies moving away from us and is likely to be a mere illusion and a misinterpretation. That is, if a galaxy is at a distance D relative to us (the centre of our corrected Schwarzschild sphere) then it is at distance D relative to the corrected Schwarzschild radius and this is then the gravitational redshift and not a redshift caused by the motion of the galaxy. It has nothing to do with the fact that the universe is expanding. There is no need for a big bang in our theory, yet it still fits the Hubble law very well that the redshift is changing over distance as observed from our point.

7 Table summary

Table 1 compares standard cosmology with cosmology from collision space-time theory.

Table 2 shows how our modified theory perfectly fits the Planck mass particle and the Hubble sphere (corrected Schwarzschild sphere). While the standard theory do not match up with neither the Planck mass or the Hubble sphere as something very unique. The reason is likely that they have been over focused on fitting their theory to Minkowski space time (four vector) theory, rather than investigating matter, relativistic mass and such things in deeper detail to see if that can lead to a more complete theory, something we are confident it dose.

	Standard model: Lambda-CDM:	Collision space-time :
13.7 billion years	Time since the Big Bang	Aggregated collision time of all particles in the Hubble sphere over the Planck time
Reduced Compton wavelength Hubble sphere mass	They never mentioned it	It is the aggregate of Compton wavelength from subatomic particles.
1.33×10^{26} meter	Hubble radius	Radius where escape velocity is c for observed density in our universe
Escape velocity	Non relativistic (and wrong)	Relativistic
8.8×10^{26} m radius	inflated universe radius (fudge)	No meaning
Supernova observations	explained with dark energy inflation (fudge)	Fits predictions extremely well
Expanding universe	Yes	No (it is infinite)
Before Big Bang?	Mystery	No beggining
Galaxy rotations	Need dark matter (fudge)	Fits without dark matter
What started the Big Bang?	Mystery	Not needed
End of universe	Cold death	No end
Unified gravity and QM	No	**YES**
Infinite problems	Many	No (as we know about)
CMB	Claimed fit to expansion model	Not looked at yet
Space-Time	4-Dimensional $(1 + 3 = 4)$	3-Dimensional $(3 + 3 = 6)$

Table 1: The table compares standard cosmology with cosmology from collision space-time theory.

	Standard model (GR):	**Collision space-time :**
Ignoring relativistic mass	Yes	No
Escape velocity derivation	$\frac{1}{2}mv^2 - G\frac{Mm}{R} = 0$ or GR	$\gamma mc^2 - mc^2 - G\frac{Mm\gamma}{R} = 0$ Observed from M
Escape velocity	$v_e = \sqrt{\frac{2GM}{R}}$ Non relativistic Newton = GR Correct by ignoring relativistic mass?	$v_e = \sqrt{\frac{2GM}{R} - \frac{G^2M^2}{c^2R^2}}$ Relativistic Newton $\neq$ GR
Radius when $v_e = c$	$R_s = \frac{2GM}{c^2}$	$\bar{R}_s = \frac{GM}{c^2}$
Escape velocity at $R = l_p$ for Planck mass	$v_e = \sqrt{2}c$ (impossible)	$v_e = c$
Escape velocity c at $R = \lambda$	$\sqrt{\pi} m_p$	$\sqrt{2\pi} m_p$
Smallest mass with escape radius equal to reduced Compton length, $R = \bar{\lambda}$	$\sqrt{\frac{1}{2}} m_p$	m_p (Planck mass)
Radius with escape velocity c for Planck mass	$R_s = 2l_p$	$\bar{R}_s = l_p$
Radius where $v_e = c$ for universe density	$R_s = 2R_h$	$\bar{R}_s = R_h$
Hubble constant	H_o	$\frac{1}{M_u}$
Hubble time Interpretation	$\frac{1}{H_o} \approx 13.8$ billion years Time since the Big Bang	$M_u \approx 13.8$ billion years Collision time per Planck time of the mass inside Hubble sphere.

Table 2: We see the Planck mass and the Hubble mass is unique and both related to escape velocity c under collision-time. Under standard theory one need and adjusted Planck mass and an adjusted Hubble mass to link them to the Schwarzschild radius. The collision space-time theory says that exactly the Planck mass and the Hubble mass are very special, this is not the case in standard theory.

8 Critics of the standard Hubble interpretation

As we have shown, even under standard theory based on the assumption of a uniform universe, when we are dealing with enormous distances, then also the standard assumed mass density of the universe will have a Schwarzschild radius that is smaller than the assumed radius of the universe, $R_u \approx 8.8 \times 10^{26}$ after taking into account the hypothetical inflation. This would mean we are living inside a black hole or in between black holes. This also means that the Big Bang itself must have exploded inside its own black hole, which indeed sounds quite absurd, so we have reasons to think it is not true. We personally think many of the known interpretations of black holes are likely to be incorrect. With a mass density of $\rho = \frac{1}{2}\frac{c^3}{GH_o}$, there will be about 9 super big black holes in the universe within a sphere with radius of 8.8×10^{26} m, and we must be inside one of these or in between them. On can naturally try to get away from such interpretations by claiming inflating space is hindering these black holes from forming in normal ways etc. The standard theory is full of patches to fill the holes. A much simpler theory is that a black hole is not a black hole at all, but just a sphere where information outside has not had time to act on what we have observed. However, this should be investigated further, see, in particular, our interpretation of micro "black-holes" that should be called micro solids under collision-space time [1].

As every mass density (if large enough) has a Schwarzschild radius, and we are inside, based on calculations, why should this not give any special gravitational effects on redshifts? We need no expanding universe model to get this to work.

Furthermore, Big Bang theory cannot explain in a simple way why all the mass in the universe was caught up in a singularity before the Big Bang, nor does it provide a good model of what triggered the Big Bang. Even if this was the case, it would result in an overly complex model. It is also much more unlikely that we are just here now in a liveable part of the universe within a universe that is assumed to be expanding and ending in cold death, than in an infinite universe in space and time. In a Big Bang universe, there is an infinite time period in cold death, at least, if there is not a mechanism for contraction and many big bangs, so why should we be here just now in a time period that is incredibly short compared to the cold death time of the universe (infinite). It could naturally be a coincidence, as we are clearly here. On the other hand, in an infinite universe in space and time, there are almost certainly always spots in the universe that are inhabitable with intelligent life, and we are just one of theses now. In the infinite universe, there could always be some intelligent beings on planets here and there wondering around the universe, in other words it is more likely we are in such a universe, as such a situation always exists somewhere in such a universe.

The fact that mass in the standard model at the deepest level does not have spatial dimensions is also strange. In our theory, the smallest particle is an indivisible particle with a length equal to the Planck length and this is not something we just assume, except that it is indivisible. We get its length from our gravity observations when calibrating our model, as described in [1]. Newton [40] in principia explicitly mentioned that the ultimate building blocks of matter had a spatial dimension, so much of our work is in his footsteps.

In standard theory, both the escape velocity and Schwarzschild radius do not really match up with the Planck mass (without altering it to a non-Planck mass) and do not match with the Hubble radius without altering it. In our theory, on the other hand, the correct relativistic escape velocity and the corrected Schwarzschild radius perfectly match up with two very special objects, namely the Planck mass and the Hubble sphere mass. We think this is no coincidence and ask the physics community to think openly about the possibilities here, before they prematurely exclude this theory. There again, many of the most famous researchers have built their fame on a fundament that we think is partly flawed, so we do not expect a warm welcome.

Our theory seems to give simple way to unify gravity with quantum mechanics as we have shown in recent published and unpublished papers. What happened with Ockham's razor? In a series of papers, we have recently presented a theory that lets us unify gravity and quantum mechanics, not by making the theory much more complex as attempted, but by dramatically simplifying the existing theory. This is because much of the current theory is simply a derivative of a deeper and simpler reality that we have described in our previous papers on collision space-time.

9 Conclusion

The Hubble radius is identical to the corrected Schwarzschild radius. This is concluded after corrections were made for relativistic mass. The so-called age of the universe since the Big Bang, approximately 13.8 billion years ago, is just one possible interpretation of the observed cosmological redshift given by the Hubble observed relations between distance and redshift, known as Hubble law. We have good reasons to think this interpretation is flawed. Over the years, we have developed a theory about mass and energy that gives us unification between gravity and quantum mechanics. The 13.8 billion years is simply the aggregated time for all particle collisions of all the mass inside the Hubble sphere in Planck time. We have previously shown that the duration of these collisions is the very essence of gravity. It is likely to take years, but we think more researchers should look into our theory. It gives a simpler explanation of the universe and it fits, for example, with supernova data without the invention of dark energy.

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