A New Way to Write The Newtonian Gravitational Equation Resolves What The Cosmological Constant Truly Is

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Abstract

We demonstrate that there is a way to represent Newtonian gravity in a form that strongly resembles Einstein's field equation, but it is still a fundamentally different type of equation. In the non-relativistic regime, it becomes necessary to ad hoc introduce a cosmological constant in order to align it with observations, similar to Einstein's field equation. Interestingly, in 1917, Einstein also ad hoc inserted a cosmological constant in the Newtonian equation during his discussion on incorporating it into his own field equation. At that time, the cosmological constant was added to maintain consensus, which favored a steady-state universe.

However, with the discovery of cosmological redshift and the shift in consensus towards an expanding universe, Einstein abandoned the cosmological constant. Then, around 1999, the cosmological constant was reintroduced to explain recent observations of distant supernovae. Currently, the cosmological constant is once again a topic of great interest and significance.

Nevertheless, we will demonstrate that the cosmological constant is likely an ad hoc adjustment resulting from a failure to properly account for relativistic effects in strong gravitational fields. We are able to derive the cosmological constant and show that it is linked to corrections for relativistic effects in strong gravitational fields. In our model, this constant holds true for any strong field but naturally assumes different values, indicating that it is not truly a constant. Its value is constant only for the mass under consideration; for example, for the Hubble sphere, it always has the same value.

Additionally, we will demonstrate how relativistic modified Newtonian theory also seems to resolves the black hole information paradox by simply removing it. This theory also leads to the conservation of spacetime. In general relativity theory, there are several significant challenges. One of them is how spacetime can change over time, transitioning from infinite curvature just at the beginning of the assumed Big Bang to essentially flat spacetime when the universe end up in cold death, while still maintaining conservation of energy all the way from the Big Bang to the assumed cold death of the universe. Can one really get something from nothing?

Key Words: Cosmological constant, New metric, Newton gravity, relativistic Newton, Bagge-Phipps model.

1 Introduction

In this paper, we explore the process of rewriting one of the fundamental Newtonian equations to closely resemble Einstein's field equation, but it is still a very different equation. By doing so, we also arrive at the Friedmann [1] equation of the universe, which requires the inclusion of a cosmological constant through an ad hoc insertion when not taking into relativistic effects, that is working with standard Newton theory. Einstein himself ad hoc introduced the cosmological constant in both Newton's theory and his field equation, a point we will delve into shortly.

Remarkably, when we apply a similar approach to a relativistic modified Newtonian model dating back to Bagge [2] and Phipps [3], we obtain a cosmological constant that is identical to Einstein's, but without the need for an ad hoc insertion. Rather, this constant arises naturally from the derivation process. This demonstrates that the cosmological constant is a necessary relativistic adjustment. However, this relativistic adjustment serves a greater purpose; it represents the necessary relativistic adjustment required to accurately describe strong gravitational fields and is not only relevant for cosmos and the Hubble sphere but for any gravitational object, it is when generalized not a constant but a relativistic adjustment variable. Based on this finding, we argue that general relativity, or at least the metrics applied so far, may have misunderstood the nature of the universe. The cosmological constant, which they consider as an inherent component, is, in fact, an ad hoc adjustment necessary for accurately describing relativistic effects in strong gravitational fields.

Our approach to rewriting the Newtonian formula and the relativistic Newtonian formula yields two novel spacetime metrics. One is applicable solely to weak fields with strong similarities to the Schwarzschild metric which recent research indicates is only valid in weak fields, while the other metric we will derive from relativistic modified Newtonian theory is valid in both weak and strong fields. Although gravity causes curvature in space and time, the spacetime interval itself remains flat in our model. Our model predicts the conservation of spacetime curvature, and intriguingly, this appears to address Hawking's black hole information paradox.

This paper presents a fresh interpretation of both general relativity and Newtonian gravity theory. It suggests that the relativistic modified Newtonian theory possesses greater power and potential than previously understood. A recent exact solution and metric to Einsteins field equation suggested by Haug and Spavieri [4] makes the two methods quite close, but still it seems different, in that general relativity do not predict conservation of spacetime curvature, while relativistic modified Newton theory do.

2 Background on the Cosmological constant

Einsein [5] in 1915 to 1916 introduced his general relativity theory through with a new field equation that was given by (in todays modern notation)

$$\begin{aligned} G_{\mu\nu} &= \kappa T_{\mu\nu} \\ R_{\mu\nu} - \frac{1}{2} R g_{\mu\nu} &= \frac{8\pi G}{c^4} T_{\mu\nu} \end{aligned} \tag{1}$$

where $R_{\mu\nu}$ represents the Ricci tensor, $g_{\mu\nu}$ denotes the metric tensor, and $T_{\mu\nu}$ represents the stress-energy tensor, G is Newtons gravitational constant, c is the speed of light.

Einstein [6] in 1917 ad hoc inserted a constant to counterbalance the effect of gravity and achieve a static universe and then got

$$\begin{aligned} G_{\mu\nu} - \lambda g_{\mu\nu} &= \kappa T_{\mu\nu} \\ R_{\mu\nu} - \frac{1}{2} R g_{\mu\nu} - \lambda g_{\mu\nu} &= \frac{8\pi G}{c^4} T_{\mu\nu} \end{aligned} \tag{2}$$

Where λ is now known as Einstein's cosmological constant. He called this his extended field equation as it was clearly an extension of his previous field equation. The consensus back then was that the universe had always been and would always be similar to what is observed now; there had been no big bang, and there was no expansion of the universe. Einstein inserted the constant ad hoc, but it was based on solid reasoning (philosophying) from Newton's gravity, cosmology, and the general theory of relativity. In 1917, he defined this constant as $\lambda = \frac{1}{r^2}$, where r was related to the radius of the universe. The cosmological redshift and the Hubble constant were discovered years after Einstein introduced the cosmological constant. However, it is interesting to note that if Einstein had inputted the Hubble radius into his cosmological constant equation in 1917, he would have obtained $r = r_H = \frac{c}{H_0}$. In that case, his constant would become

$$\lambda = \frac{1}{r^2} = \frac{1}{r_H^2} = \left(\frac{H_0}{c}\right)^2 \tag{3}$$

This is very similar to what is considered the cosmologican constant today

$$\Lambda = \frac{3}{r^2}\Omega_\Lambda = \frac{3}{r_H^2}\Omega_\Lambda = 3\left(\frac{H_0}{c}\right)^2 \Omega_\Lambda \tag{4}$$

where Ω_Λ is the energy density ratio due to the cosmological constant and the critical density of the universe. For the critical Friedmann [1] universe $\Omega_\Lambda = 1$, so Einsteins original cosmological constant corresponded to this. The Firedmann eqations where first published in 1922, so we are talking about relative to what we know today, not from what Einstein could know then. So Einsteins cosmological constant correspond to what today could be called a steady state Hubble sphere universe. In Einsteins view in 1917 it was not that the universe not was infinite, it was that there was actually a limit on how far a distance gravitational effects could work in addition to his belive of a steady state universe.

An important point to note is that in his 1917 paper, Einstein significantly built up his arguments based on Newtonian theory. Please keep this in mind as we proceed with the paper. In the same paper, Einstein ad hoc inserted the cosmological constant into the Poisson equation, which is related to Newton's equation. The Poisson equation is typically given as:

$$\nabla^2 \phi - \lambda\phi = 4\pi G\rho \tag{5}$$

However, Einstein speculatively suggested including a constant related to the cosmos:

$$\nabla^2 \phi - \lambda\phi = 4\pi G\rho \tag{6}$$

He then proposed $\phi = \frac{-4\pi G}{\lambda}\rho_0$, where ρ_0 represents the mean density of matter in the universe.

Since the cosmological constant was ad hoc inserted, but based on sound reasoning and not derived from any existing framework, it had to be calibrated to observations. Essentially, this means that it is a free parameter that can be adjusted to make Einstein's field equation align with observations from the universe.

When Hubble [7] discovered that most astronomical objects were red-shifted, the consensus gradually shifted. While there were multiple possible explanations for the observed cosmological redshift, such as tired light suggested by Zwicky [8], a consensus slowly emerged that the cosmological redshift indicated that most objects were moving away from us. This was interpreted as the universe expanding and likely having originated from a Big Bang. As the cosmological constant was introduced to maintain a steady-state universe consistent with the general theory of relativity, Einstein accepted the expanding-dynamic universe model around 1931. The Einstein–de Sitter spacetime was consistent with a continuously expanding Universe with zero cosmological constant.

Supposedly, Einstein later referred to the inclusion of the cosmological constant in his field equation as his biggest blunder. However, there is some uncertainty regarding whether Einstein actually made this statement, as it is only indirectly attributed to him through Gamow [9]. Nevertheless, at this point, the cosmological constant was either discarded or, alternatively, set to zero.

In 1998, two teams of astrophysicists, one led by Saul Perlmutter [10] and another led by Brian Schmidt and Adam Riess [11], conducted measurements and analyzed distant supernovae. The results indicated that the expansion of the universe was accelerating. To reconcile these findings with general relativity, the cosmological constant had to be reintroduced and somewhat reformulated.

Gravity, as we understand it locally, such as on Earth and in the solar system, is attractive and in general relativity is caused by the curvature of spacetime resulting from mass (energy) curving spacetime. Therefore, it logically follows that a universe with mass should eventually contract or at least cease expanding and reach a state of balance, even if there was a big bang. This was the prevailing view discussed in the 1980s and early 1990s. However, the interpretation of supernova data as indicating accelerated expansion challenged this perspective. To explain the data from Type Ia supernovae, a new hypothesis had to be introduced, which is now known as dark energy and accelerating expansion. Dark energy is currently the consensus among most experts in gravity and astrophysics, although direct evidence of its existence is still lacking, with only indirect indications.

In this paper, we will demonstrate for the first time that the cosmological constant arises directly from Newton's theory when considering relativistic energy. It is then a more general variable that is directly related to taking into account relativistic effects. In the special case of the Hubble sphere it takes an almost identical value that was suggested by Einstein. The relativistic model also seems to remove the need for the dark energy hypothesis [12].

3 A New Way to Newtonian Non-Relativistic Formula Resembles Einsteins field equation without the cosmological constant

The gravitational force formula in modern times[1] is expressed as follows:

$$F = G\frac{Mm}{r^2} \tag{7}$$

This equation is closely related to the well-known equation:

$$\frac{1}{2}mv^2 - G\frac{Mm}{r} = 0 \tag{8}$$

The above equation is valid for a spherical gravitational object M acting on a small mass m, where $m \ll M$. It is applicable in the radial direction. This formula is often utilized to solve for the escape velocity, denoted as v_e, and it yields the well-known escape velocity formula:

[1] This was not Newton's original formula; see [13, 14].

$$v_e = v = \sqrt{\frac{2GM}{r}} \tag{9}$$

We can also solve this formula for r when setting $v_e = c$. This results in $r = \frac{2GM}{c^2}$, which is identical to the radius obtained for black holes from the Schwarzschild metric. As early as 1784, Michell [15] calculated such a radius based on Newton's gravity (albeit only describing it verbally) and predicted the existence of dark stars from which even light could not escape. During that time, in 1784, the theory of relativity had not yet been developed, so this equation was correct based on the knowledge available at that time (but naturally had its limitation as relativity theory not yet was discovered).

Furthermore, the escape velocity in the Schwarzschild metric is identical to the one obtained in Newtonian gravity (see [16] for more details). Even this fact raises questions because the derivation of the escape velocity in Newtonian gravity is certainly not valid in a strong gravitational field. The derivation begins by using the kinetic energy formula $E_k \approx \frac{1}{2}mv^2$ (seen as part of Eq. 8), which is well-known to be valid only when $v \ll c$. This condition holds only when $r \gg r_s$. The formula $E_k \approx \frac{1}{2}mv^2$ is equivalent to the first term of a Taylor series expansion of Einstein's special relativistic kinetic energy: $E_k = mc^2\gamma - mc^2$. The first term of the Taylor series expansion is indeed valid as a good approximation only when $v \ll c$.

How is it possible that the Schwarzschild metric, widely accepted as being fully valid in both weak and strong gravitational fields by the general relativity community, yields exactly the same escape velocity and escape radius (where $v_e = c$) as the standard non-relativistic Newtonian gravity? This is perplexing considering that Newton's theory is known to be invalid in strong gravitational fields. No one can truly explain this. Some consider it to be a mere coincidence, for instance, Loinger [17] claims, "*The dark body of Michell-Laplace has nothing to do with the relativistic black hole.*" On the other hand, Hawking [18] seems to think that there might be more to it than just coincidence. After all, Newton's theory is recovered from the Schwarzschild metric in the weak field. However, this does not explain why the Schwarzschild metric predicts exactly the same results as Newton's theory for quantities such as the escape velocity and event horizon, which are related to strong gravitational fields

While it is understandable that the Schwarzschild metric predicts mostly the same results as Newton's theory in the weak field when $r \gg r_s$, the fact that it also predicts similar outcomes in very strong gravitational fields raises questions. This is one of the multiple aspects we will investigate in this paper. In certain aspects of the strong field, the Schwarzschild metric predicts results that are very different from those of Newton's theory, something we will get back to.

The escape velocity derived from the Newton formula in Eq. 8 is naturally the only one that is valid for that equation. Now, we can substitute this escape velocity back into Eq. 8 and obtain:

$$\begin{aligned}
\frac{1}{2}mv_e^2 - G\frac{Mm}{r} &= 0 \\
\frac{2GM}{r} &= \frac{2GM}{r} \\
1 - \frac{2GM}{c^2r} &= 1 - \frac{2GM}{c^2r} \\
1 - \left(1 - \frac{2GM}{c^2r}\right) &= \frac{2GE}{c^4r} \\
1 - \left(1 - \frac{2GM}{c^2r}\right) &= \frac{8\pi G}{c^4}\frac{E}{\frac{4}{3}\pi r^3}\frac{r^2}{3} \\
\frac{3}{r^2} - \frac{3}{r^2}\left(1 - \frac{2GM}{c^2r}\right) &= \frac{8\pi G}{c^4}\frac{E}{\frac{4}{3}\pi r^3}
\end{aligned} \tag{10}$$

The term $\frac{E}{\frac{4}{3}\pi r^3}$ can be referred to as the energy density per unit volume, denoted by the symbol $\rho_E = \frac{E}{\frac{4}{3}\pi r^3}$. It simply represents the rest mass energy of the gravitational object divided by the volume of the sphere with radius r. By substituting this back into the equation above, we obtain:

$$\frac{3}{r^2} - \frac{3}{r^2}\left(1 - \frac{2GM}{c^2r}\right) = \frac{8\pi G}{c^4}\rho_E \tag{11}$$

The Gauss curvature of a normal sphere (2-sphere) is $\frac{1}{r^2}$, and the Ricci scalar curvature of a 2-sphere is $\frac{2}{r^2}$. Therefore, we propose calling $\frac{3}{r^2}$ the curvature, or one can naturally refer to it as three times the Gauss curvature or $\frac{3}{2}$ times the Ricci scalar curvature. The specific name we assign to it is not crucial. We will denote it as $R_i = \frac{3}{r^2}$, which simplifies the notation without changing the equation. Additionally, we use the symbol g_m to represent what we will call the metric component: $\left(1 - \frac{2GM}{c^2 r}\right)$. Although this metric component is not the complete spacetime metric associated with the Newton metric (which we will discuss later), it plays a central role in the metric. It is worth noting that this metric component is identical to the term multiplied by c^2dt^2 in the Schwarzschild metric: $ds^2 = \left(1 - \frac{2GM}{r}\right)c^2dt^2 - \left(1 - \frac{2GM}{r}\right)^{-1} - g_\Omega$. In other words, the Newton metric component is equivalent to the g_{00} tensor component in the Schwarzschild metric. We believe this goes beyond mere coincidence, which we will explore further later on.

By replacing the metric component $\left(1 - \frac{2GM}{c^2 r}\right)$ with the symbol g_m and $\frac{3}{r^2}$ with R_i in Equation 11, we obtain:

$$R_i - R_i g_m \quad = \quad \frac{8\pi G}{c^4}\rho_E \tag{12}$$

This expression bears a striking resemblance to Einstein's field equation [5], despite being mathematically different. It essentially represents a reformulated version of the linear Newtonian radial equation we started with. The original Einstein field equation without the cosmological constant can be written as $R_{\mu\nu} - \frac{1}{2}Rg_{\mu\nu} = \frac{8\pi G}{c^4}T_{\mu\nu}$.

The Einstein field equation consists of tensors and represents 16 equations in reality. On the other hand, the Newtonian equation we have presented here is a simple equation that requires only high school mathematics to understand and does not involve tensors. However, we find it intriguing that we can express the Newtonian gravity equation in this manner. The concept of energy density per unit volume, which we introduced, shares similarities with the stress-energy tensor in Einstein's field equation. Both involve energy per unit volume, although in tensor form (the stress-energy tensor) in Einsteins field equation, can contain also other quantities like pressure and shear stress.

The metric component we referred to in the Newtonian equation, $g_m = \left(1 - \frac{2GM}{c^2 r}\right)$, exhibits strong resemblances to the Schwarzschild metric derived from Einstein's field metric, $g_{\mu\nu}$, as we discussed earlier and will explore further.

4 A New Way to Newtonian Relativistic Modified Formula Resembles Einsteins field equation with the cosmological constant

Next, let us consider the relativistic modification of Newton's theory. Independently, Bagge [2] and Phipps [3] have suggested incorporating relativity theory into Newton's gravity by simply re-writing the Newtonian gravitational force formula as:

$$F = G\frac{Mm\gamma}{r^2} \tag{13}$$

Here, γ represents the Lorentz factor, given by $\gamma = 1/\sqrt{1 - v^2/c^2}$. Consequently, the Newtonian radial equation related to escape velocity must be:

$$mc^2\gamma - mc^2 - G\frac{Mm\gamma}{r} = 0 \tag{14}$$

Solving for v, we obtain the escape velocity as (see [19]):

$$v_e = v = \sqrt{\frac{2GM}{r} - \frac{G^2M^2}{c^2r^2}} \tag{15}$$

To find the radius where the escape velocity is equal to the speed of light (c), we solve the following equation for r:

$$v_e = c = \sqrt{\frac{2GM}{r} - \frac{G^2M^2}{c^2r^2}} \tag{16}$$

This gives us:

$$r = \frac{GM}{c^2} \tag{17}$$

This radius is half of the Schwarzschild radius, which will be significant later on. To distinguish it from the Schwarzschild radius $r_s = \frac{2GM}{c^2}$, we will denote it as r_c. We can rewrite Equation 14 by substituting the escape velocity and rearranging it as follows:

$$
\begin{aligned}
1-\sqrt{1-v_e^2/c^2}-G\frac{M}{c^2 r} &= 0\\
v_e^2 &= \frac{2GM}{r}-\frac{G^2M^2}{c^4r^2}\\
1-\frac{2GM}{c^2r}+\frac{G^2M^2}{c^4r^2} &= 1-\frac{2GM}{c^2r}+\frac{G^2M^2}{c^4r^2}\\
\frac{G^2M^2}{c^4r^2}+1-\left(1-\frac{2GM}{c^2r}+\frac{G^2M^2}{c^4r^2}\right) &= \frac{2GM}{c^2r}\\
\frac{3G^2M^2}{c^4r^4}+\frac{3}{r^2}-\frac{3}{r^2}\left(1-\frac{2GM}{c^2r}+\frac{G^2M^2}{c^4r^2}\right) &= \frac{8\pi G}{c^4}\frac{E}{\frac{4}{3}\pi r^3}\\
\frac{3G^2M^2}{c^4r^4}+R_i-R_i g_m &= \frac{8\pi G}{c^4}\rho_E
\end{aligned} \tag{18}
$$

We will now introduce the term $\Lambda_N=\frac{3G^2M^2}{c^4r^4}$. At this stage, the factor Λ_N does not resemble the cosmological constant, and it is not even a constant itself, except for the symbol we use. However, we will soon discover something very interesting about how it is directly linked to the cosmological constant. Notably, the term $\Lambda_N=\frac{3G^2M^2}{c^4r^4}$ was not present when we derived a similar equation from non-relativistic Newtonian principles. We can now express the relativistic Newtonian radial equation as follows:

$$
\Lambda_N+R_i-R_i g_m=\frac{8\pi G}{c^4}\rho_E \tag{19}
$$

Since $\Lambda_N=\frac{3G^2M^2}{c^4r^4}$ appears as an additional term when we rewrote the relativistic Newton formula in this form compared to the non-relativistic case, it is correct to call Λ_N a relativistic correction factor, as it adjusts the formula for relativistic effects. This on the surface strongly resembles Einsteins field equation with the cosmological constant ad-hoc inserted.

In the special case when we apply Eq. 19 to the cosmos, specifically the Hubble sphere, we consider $r=r_H$ as the Hubble radius, particularly when dealing with observations (photons) coming from close to that radius. Therefore, in this specific case, the Hubble radius in this model is given by $r=r_H=\frac{GM_u}{c^2}$, where $M_u=\frac{c^3}{GH_0}$ is the mass equivalent of all mass and energy in the Hubble sphere. We obtain this mass by solving the formula $r_c=\frac{GM}{c^2}$ for M, which gives $M=\frac{c^2r_c}{G}$. When $r_c=r_H=\frac{c}{H_0}$, we have $M=\frac{c^2r_H}{G}=\frac{c^3}{GH_0}$. This means that in the special case of the Hubble sphere, the relativistic variable Λ_N becomes:

$$
\Lambda_N=\frac{3G^2M_u^2}{c^4r_H^4}=\frac{3G^2M_u^2}{c^4\left(\frac{GM_u}{c^2}\right)^4}=\frac{3}{r_c^2}=\frac{3}{r_H^2}=3\left(\frac{H_0}{c}\right)^2\approx 1.72\times10^{-52}\ \mathrm{m} \tag{20}
$$

Remember that in his 1917 paper, when Einstein first introduced the cosmological constant, he defined it as $\lambda=\frac{1}{r^2}$, where r represented the radius of the cosmos. Therefore, what we have derived here bears a great similarity to that concept. The value $\Lambda_N=3\left(\frac{H_0}{c}\right)^2\approx 1.72\times10^{-52}$ meter is a special case of the Newton relativistic variable (Λ_N) that remains constant when applied to the Hubble sphere. Interestingly, it is identical to the modern interpretation of Einstein's cosmological constant: $\Lambda=3\left(\frac{H_0}{c}\right)^2\Omega_\Lambda$, where Ω_Λ is set to 1.

So, for the Hubble sphere, we have:

$$
\begin{aligned}
\Lambda_N+R_i-R_i g_m &= \frac{8\pi G}{c^4}\rho_E\\
3\frac{1}{r_H^2}+R_i-R_i g_m &= \frac{8\pi G}{c^4}\rho_E\\
3\left(\frac{H_0}{c}\right)^2+R_i-R_i g_m &= \frac{8\pi G}{c^4}\rho_E
\end{aligned} \tag{21}
$$

Furthermore, in the special case where $r=r_c=\frac{GM}{c^2}$, our metric component becomes:

$$
\begin{aligned}
g_m &= \left(1 - \frac{2GM}{c^2 r} + \frac{G^2M^2}{c^2r^2}\right) \\
g_m &= \left(1 - \frac{2GM}{c^2\frac{GM}{c^2}} + \frac{G^2M^2}{c^2\left(\frac{GM}{c^2}\right)^2}\right) = 0 \qquad (22)
\end{aligned}
$$

Thus, $R_i g_m = 0$, and we end up with:

$$
\begin{aligned}
3\left(\frac{H_0}{c}\right)^2 + R_i &= \frac{8\pi G}{c^4}\rho_E \\
3\left(\frac{H_0}{c}\right)^2 + \frac{3}{r_H^2} &= \frac{8\pi G}{c^4}\rho_E \\
\Lambda_H + \frac{3}{r_H^2} &= \frac{8\pi G}{c^4}\rho_E \\
\frac{H_0^2}{c^2} &= \frac{\frac{8\pi G}{c^4}\rho_E - \Lambda_N}{3} \\
H_0^2 &= \frac{\frac{8\pi G}{c^2}\rho_E - \Lambda_N c^2}{3} \\
H_0^2 &= \frac{8\pi G\rho - \Lambda_N c^2}{3} \qquad (23)
\end{aligned}
$$

Here, ρ represents the mass density (equivalent mass, $\rho = \frac{\rho_E}{c^2}$). Remarkably, this equation is identical to the Friedmann equation derived from Einstein's general relativity theory. However, there is a significant difference in how it was derived. In Einstein's case, the cosmological constant is ad hoc inserted into the field equation. On the other hand, when using relativistic Newtonian theory, we did not need to insert any constant ad hoc. We have demonstrated that the so called cosmological constant is simply a relativistic correction that arises directly from relativistic Newtonian theory. Be aware that the general relativity community long time ago started ignoring relativistic Newton theory before properly investigating what predictions it could lead to. Well to do that require some luck together with some skills, and a lot of hard work.

However, as the cosmological constant has not been previously discovered as a special case of a relativistic variable, it suggests that in general relativity theory, one may be neglecting an important relativistic component when not dealing with the cosmos. Naturally unknowingly so. This implies that fully relativistic metrics may not be obtained when solving the field equation without such an adjustment. Whether a similar adjustment can be directly incorporated into general relativity theory is unclear, and it raises the question of whether it is even necessary. Assuming that we have mistakenly calibrated our equation to Newtonian gravity without considering relativistic effects, as we showed earlier:

$$
\begin{aligned}
\frac{3}{r^2} - \frac{3}{r^2}\left(1 - \frac{2GM}{c^2 r}\right) &= \frac{8\pi G}{c^4}\frac{\rho_E}{\frac{4}{3}\pi r^3} \\
R_i - R_i g_m &= \frac{8\pi G}{c^4}\frac{\rho_E}{\frac{4}{3}\pi r^3} \qquad (24)
\end{aligned}
$$

If we are unaware of the relativistic solution, similar to Einstein's approach when working with the cosmos, we can attempt to solve this equation by ad hoc inserting the well-known cosmological constant $\Lambda = 3\left(\frac{H_0}{c}\right)^2$ into our non-relativistic Newtonian equation. This gives:

$$
\begin{aligned}
\Lambda + R_i - R_i g_m &= \frac{8\pi G}{c^4}\frac{\rho_E}{\frac{4}{3}\pi r^3} \\
3\left(\frac{H_0}{c}\right)^2 + \frac{3}{r^2} - \frac{3}{r^2}\left(1 - \frac{2GM}{c^2 r}\right) &= \frac{8\pi G}{c^4}\frac{\rho_E}{\frac{4}{3}\pi r^3} \qquad (25)
\end{aligned}
$$

The metric component in this case remains non-relativistic since we are working within the framework of non-relativistic Newtonian physics and have not adjusted the metric for the cosmological constant. Instead, we have ad hoc inserted the cosmological constant, which is not an ideal approach. However, since we assume that we are not familiar with or working within relativistic Newtonian theory (which surprisingly applies within the general relativity community), the Hubble radius corresponds to $r_H = r_s = \frac{c}{H_0} = \frac{2GM_c}{c^2}$, where the mass M_c represents the critical mass in the Friedmann universe: $M_c = \frac{c^3}{2GH_0}$. This differs from the mass in relativistic Newtonian theory by a factor of $\frac{1}{2}$. Therefore, we obtain:

$$\begin{aligned} 3\left(\frac{H_0}{c}\right)^2 + \frac{3}{r_H^2} &= \frac{8\pi G}{c^4}\rho_E \\ \frac{3}{r_H^2} &= \frac{8\pi G}{c^4}\rho_E - \Lambda \\ \frac{H_0^2}{c^2} &= \frac{\frac{8\pi G}{c^2}\rho_E - \Lambda}{3} \\ H_0^2 &= \frac{8\pi G\rho - \Lambda c^2}{3} \end{aligned} \tag{26}$$

So, we were once again able to derive the Friedman equation with a cosmological constant. However, we achieved this by starting from an incorrect equation that failed to fully and properly consider relativistic effects. Nevertheless, we resolved this issue by ad hoc inserting what we referred to as a cosmological constant. This situation seems to resemble what may have actually happened in Einstein's field equation. It is well-known that the Friedmann equation can be obtained from Newtonian physics, but only by ad hoc inserting a cosmological constant. The significant breakthrough here is that such an insertion is not necessary in relativistic Newtonian theory. This finding is crucial as it suggests that when working with the cosmos and beyond, there is likely something missing in the general theory of relativity, specifically the relativistic adjustment to Newton's theory.

This implies that, for instance, the Schwarzschild metric may not be a fully relativistic metric suitable for strong gravitational fields. Schwarzschild derived this metric from Einstein's field equation even before Einstein ad hoc inserted the cosmological constant. Furthermore, to this day, it remains unclear what exactly the cosmological constant represents and why it needs to be ad hoc inserted. In relativistic Newtonian theory, we observe that it is simply a relativistic variable that should always be incorporated when dealing with strong gravitational fields, not only for cosmos, but in particular for predicting and interpreting such things as black holes, that we soon will come back to.

Consistency with previous relativistic Newtonian model of cosmos

In a recent previous paper ([19]), we derived a cosmological model from the same modified relativistic Newton theory, which was given by:

$$H_0^2 = \frac{4\pi G\rho_M}{3} \tag{27}$$

In that paper, we did not demonstrate how the cosmological constant could arise from relativistic Newton theory. However, in the derivations above, we obtained $H_0^2 = \frac{8\pi G\rho_M - \Lambda c^2}{3}$. Although they may appear different, they are actually fully consistent and equivalent, as we will now demonstrate.

The Newtonian relativistic variable Λ_N for the Hubble sphere is given by (as we demonstrated in the previous section):

$$\Lambda_N = 3\left(\frac{H_0}{c}\right)^2 \tag{28}$$

Since the mass of the universe in the relativistic Newton model is expressed as $M_u = \frac{c^3}{GH_0}$, we have $H_0 = \frac{c^3}{GM_u}$. Substituting this expression for H_0 back into the equation above, we obtain:

$$\begin{aligned}
\Lambda_N &= 3\frac{1}{\frac{G^2M_u^2}{c^6}c^2} \\
\Lambda_N &= \frac{4GM_u}{\frac{4}{3}\frac{G^3M_u^3}{c^4}} \\
\Lambda_N &= \frac{\frac{4\pi G}{c^2}M_u}{\frac{4}{3}\pi\frac{G^3M_u^3}{c^6}} \\
\Lambda_N &= \frac{\frac{4\pi G}{c^2}M_u}{\frac{4}{3}R_H^3} \qquad (29)
\end{aligned}$$

Now substituting this expression back into $H_0^2 = \frac{8\pi G\rho - \Lambda c^2}{3}$, we obtain:

$$H_0^2 = \frac{4\pi G\rho}{3} \qquad (30)$$

This result is identical to the finding in our previous paper, even though in this paper we have gone much further and demonstrated for the first time the true nature of the cosmological constant. It is a relativistic variable that, in the special case of the Hubble sphere, is indeed equivalent to the cosmological constant. Additionally, our cosmological equation 30 is considerably simpler than the Friedmann equation.

5 Finding the metric component

In the framework of relativistic Newton theory, we are presented with the equation:

$$\Lambda_N + R_i - R_i g_m = \frac{8\pi G}{c^4}\rho_E \qquad (31)$$

To determine the metric component (assuming its unknown), we can simply solve this equation for g_m, yielding:

$$\begin{aligned}
g_m &= \frac{\Lambda_N + R_i - \frac{8\pi G}{c^4}\rho_E}{R_i} \\
g_m &= \frac{\frac{3}{r^2}\frac{G^2M^2}{c^4r^2} + \frac{3}{r^2} - \frac{8\pi G}{c^4}\rho_E}{\frac{3}{r^2}} \\
g_m &= \frac{\frac{3}{r^2}\frac{G^2M^2}{c^4r^2} + \frac{3}{r^2} - \frac{8\pi G}{c^4}\frac{Mc^2}{\frac{4}{3}\pi r^3}}{\frac{3}{r^2}} \\
g_m &= \frac{\frac{3}{r^2}\frac{G^2M^2}{c^4r^2} + \frac{3}{r^2} - \frac{3}{r^2}\frac{GM}{c^2r}}{\frac{3}{r^2}} \\
g_m &= \left(1 - \frac{2GM}{c^2r} + \frac{G^2M^2}{c^2r^2}\right) \qquad (32)
\end{aligned}$$

If we mistakenly failed to recognize that Λ_N is a relativistic adjustment factor and instead assumed it to be solely a cosmological constant relevant to cosmological observations, we would likely neglect its inclusion when deriving the metric. As a result, we would obtain the following metric component:

$$\begin{aligned} g_m &= \frac{R_i - \frac{8\pi G}{c^4}\rho_E}{R_i} \\ g_m &= \frac{\frac{3}{r^2} - \frac{8\pi G}{c^4}\rho_E}{\frac{3}{r^2}} \\ g_m &= \frac{\frac{3}{r^2} - \frac{8\pi G}{c^4}\frac{Mc^2}{\frac{4}{3}\pi r^3}}{\frac{3}{r^2}} \\ g_m &= \frac{\frac{3}{r^2} - \frac{3}{r^2}\frac{GM}{c^2 r}}{\frac{3}{r^2}} \\ g_m &= \left(1 - \frac{2GM}{c^2 r}\right) \end{aligned} \tag{33}$$

This is identical to the g_{00} component in the Schwarzschild metric:

$$g_{\mu v} = \begin{pmatrix} \left(1 - \frac{2GM}{rc^2}\right) & 0 & 0 & 0 \\ 0 & -\left(1 - \frac{2GM}{rc^2}\right)^{-1} & 0 & 0 \\ 0 & 0 & -r^2 & 0 \\ 0 & 0 & 0 & -r^2 \sin^2\theta \end{pmatrix} \tag{34}$$

This could potentially imply that when deriving metrics from the Einstein field equation, if one omits the cosmological constant and is unaware that it should possibly be replaced with a relativistic variable, the resulting metrics may not be fully relativistic. Consequently, one might erroneously believe that the Schwarzschild metric is relativistic and applicable even in the case of strong gravitational fields, when in reality, it likely is not. The Schwarzschild metric remains a highly accurate approximation for predictions in weak gravitational fields. This also clarifies why the Schwarzschild metric yields the exact same escape velocity and horizon as the plain Newtonian theory. This is simply due to the fact that the Schwarzschild metric is not genuinely relativistic; it is a weak field approximation.

What is often misinterpreted as relativistic effects in general relativity theory is the assumption of curved spacetime, which will be discussed in the following section.

For example, Haug and Spavieri [20] have recently demonstrated that no mass candidate for micro black holes in when predicted or analyzed through the Schwarzschild metric can satisfy more than a few properties at the Planck scale, whereas relativistic Newtonian theory can satisfy all of them. Interestingly, the extremal solution to the Reissner-Nordström [21, 22] metric and the extremal solution to the Kerr [23] metric can also achieve the same, and the g_{00} component in the extremal case is mathematically equivalent to the relativistic Newtonian metric component we have just derived. The extremal solutions in the Reissner-Nordström and Kerr metric have got relatively little attention.

6 Curved or flat spacetime? But always curved space and time!

In the relativistic Newton case we can also derive the space-time metric by re-writing the relativistic radial equation

$$\begin{aligned} mc^2\gamma - G\frac{Mm\gamma}{r} &= 0 \\ 1 - \sqrt{1 - \frac{v_e^2}{c^2}} - G\frac{M}{c^2 r} &= 0 \\ 1 - G\frac{Mm}{c^2 r} - \sqrt{1 - \frac{v_e^2}{c^2}} &= 0 \\ \left(1 - \frac{GM}{c^2 r}\right)^2 - \sqrt{1 - \frac{\frac{2GM}{r} - \frac{G^2M^2}{c^2 r^2}}{c^2}}^2 &= 0 \\ \left(1 - \frac{2GM}{c^2 r} + \frac{G^2M^2}{c^4 r^2}\right) - \left(1 - \frac{2GM}{c^2 r} + \frac{G^2M^2}{c^4 r^2}\right) &= 0 \end{aligned} \tag{35}$$

Next we multiply dr^2 on both sides, and get

$$\left(1-\frac{2GM}{c^2r}+\frac{G^2M^2}{c^4r^2}\right)dr^2-\left(1-\frac{2GM}{c^2r}+\frac{G^2M^2}{c^4r^2}\right)dr^2=0 \tag{36}$$

Where dr is the small distance as measured from far away from the gravitational field. The time it takes to cross this small distance is $t=\frac{dr}{c}$ so $c^2dt^2=dr^2$, so we can re-write Equation 36 as

$$\left(1-\frac{2GM}{c^2r}+\frac{G^2M^2}{c^4r^2}\right)c^2dt^2-\left(1-\frac{2GM}{c^2r}+\frac{G^2M^2}{c^4r^2}\right)dr^2=0 \tag{37}$$

Which is the Newtonian spacetime metric (in only the radial direction) when taking into account relativistic effects. The horizon in this metric is given by $r_c=\frac{GM}{c^2}$. There is no singularity at the horizon, which is in strong contrast to, for example, the Schwarzschild metric where there is a singularity at $r_s=\frac{2GM}{c^2}$. In our metric, time and space are curved, but the spacetime interval is always flat and zero. This means that there is conservation of spacetime, unlike in the metrics known in general relativity theory, where spacetime varies depending on our location relative to the gravitational field.

In general relativity theory, there is also something mystical and, in our opinion, not very logical. According to general relativity, the predicted Big Bang marked the beginning of the universe with infinite spacetime curvature and a singularity with infinite energy density. Then the Big Bang occurred, and due to the assumed expansion of the universe, and even acceleration of the expansion, there will be a predicted cold death of the universe where all energy and mass is spread out over enormously large distances, resulting in basically flat spacetime. Nevertheless, in our theory, like the standard model, we assume conservation of energy. How can it be that the spacetime curvature changes dramatically during the lifetime of the universe without a change in the total energy of the universe? In our theory, there is conservation of spacetime curvature, which seems more consistent with the conservation of energy. This should naturally be discussed and investigated further.

To see the closer connection between the Schwarzschild metric and Newton theory lets look at Newton without relativistic effects. When not taking into account relativistic effects we have

$$\begin{aligned}\frac{1}{2}mv_e^2-G\frac{Mm}{r} &= 0\\ \frac{2GM}{r}-\frac{2GM}{r} &= 0\end{aligned} \tag{38}$$

Next we divide by c^2 on both sides and add and subtract one and we get:

$$\begin{aligned}1-1+\frac{2GM}{c^2r}-\frac{2GM}{c^2r} &= 0\\ \left(1-\frac{2GM}{c^2r}\right)-\left(1-\frac{2GM}{c^2r}\right) &= 0\end{aligned} \tag{39}$$

Some will possibly protest here and claim we can not just do this and get another constant in to the formula that not was there before. We will claim the speed of light already is there, not by assumption, but by calibration in G and also in M, this is discussed in Haug [24, 25].

Next we multiply with dr^2 on both sides, this gives

$$\left(1-\frac{2GM}{c^2r}\right)dr^2-\left(1-\frac{2GM}{c^2r}\right)dr^2=0 \tag{40}$$

Where dr represents a small change in the length r as measured from far away from the gravitational field. Furthermore, it will take the following time $dt=\frac{dr}{c}$ for a light signal to travel the short distance dr (think of a photon-light clock). This implies that $c^2dt^2=dr^2$. Therefore, we can rewrite the equation above as:

$$\left(1-\frac{2GM}{c^2r}\right)c^2dt^2-\left(1-\frac{2GM}{c^2r}\right)dr^2 = 0 \tag{41}$$

Since the escape velocity is $v_e=\sqrt{\frac{2GM}{r}}$, this can also be written as:

$$\left(1-\frac{v_e^2}{c^2}\right)c^2dt^2-\left(1-\frac{v_e^2}{c^2}\right)dr^2 = 0 \tag{42}$$

This equation is identical to what we obtain in Minkowski spacetime when the causal signal moves at the speed of light. Please refer to our derivation related to Minkowski spacetime further down. However, the equation derived from Newtonian theory is not relativistic, so it is only a very good approximation when $v_e \ll c$, which corresponds to $r \gg r_s = \frac{2GM}{c^2}$. We will refer to this as the Newtonian radial spacetime metric, and we claim that it represents a geometrical way to express (Eq. 8).

This metric closely resembles the Schwarzschild metric from Einstein's general relativity theory, which is given as:

$$ds^2 = \left(1 - \frac{2GM}{c^2 r}\right) c^2 dt^2 - \left(1 - \frac{2GM}{c^2 r}\right)^{-1} dr^2 - r^2 g_\Omega \quad (43)$$

where $\Omega = (d\theta^2 + \sin^2\theta d\phi^2)$, which when only working in the radial direction can be simplified to

$$ds^2 = \left(1 - \frac{2GM}{c^2 r}\right) c^2 dt^2 - \left(1 - \frac{2GM}{c^2 r}\right)^{-1} dr^2 \quad (44)$$

It is important to understand that the Schwarzschild solution was published in 1916 by Schwarzschild [26], even one year before Einstein suggested adding a cosmological constant to his field equation. As we saw in the last section, this is likely a reason why the Schwarzschild solution may not truly be relativistic. It would not be enough to add the cosmological constant and then derived a Schwarzschild type metric, one also would have to understand that the cosmological constant was a special case of a relativistic variable Λ_N.

The Schwarzschild spacetime metric for the radial direction closely resembles what we called the Newton radial spacetime metric. However, there is a major difference: the term in front of dr^2 is raised to the power of -1 in the Schwarzschild metric and to the power of 1 in the Newton radial metric. This means that time is affected identically by gravitational time dilation in the two metrics, and they will predict the same gravitational red-shift also, but distances (in the length transformation) are expanding in our metric and contracting as predicted in the Schwarzschild metric closer to the gravitational field. One must be careful here and not mistake distance expansion with length contraction or expansion. Even in the Minkowski metric, there is distance expansion (the Lorentz length transformation) and length contraction that is derived from the Lorentz transformation, just like in our Newtonian metric. However, in the Schwarzschild metric, there is distance contraction in addition to length contraction.

This means that our new Newtonian metric always predicts flat spacetime, while the Schwarzschild metric predicts curved spacetime. Bear in mind that spacetime is defined as the difference between the space and time interval. In the Newton metric, time and space curve in the same direction, and since the spacetime interval is defined as the time interval minus the space interval, the spacetime interval will be flat in this Newton metric. Furthermore, our metric will not have any singularity before $r = 0$, while the Schwarzschild metric has a singularity at $r = r_s = \frac{2GM}{c^2}$ and at $r = 0$. We will discuss this further later on.

Figure 1 shows the time-interval as we move from outside the black hole and in to the horizon of the black hole. Time is clearly curved by the gravitational field, something also space will be.

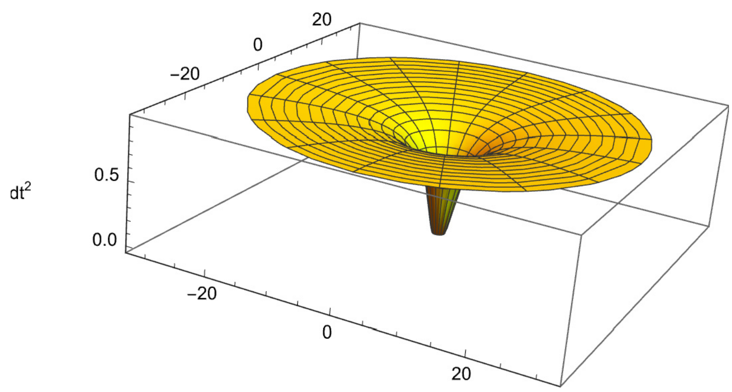

Figure 1: The figure shows the time interval in the new metric as we move towards the center of the gravitational object. In this plot, we start at a distance of $R = 30\frac{GM}{c^2}$ and move inwards to $R = \frac{GM}{c^2}$.

Figure 2 shows the spacetime interval from our metric. It is always flat and zero.

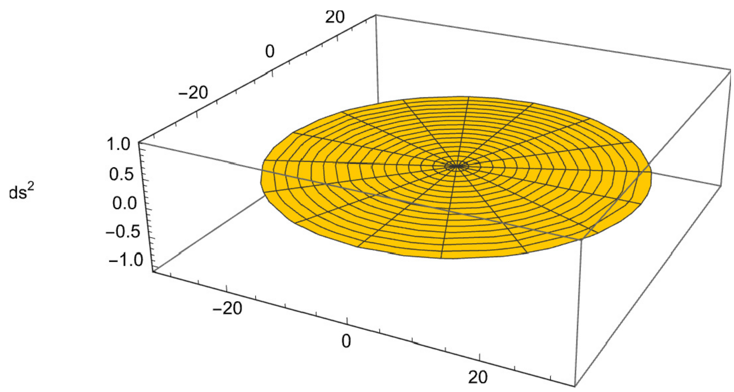

Figure 2: The figure shows the spacetime interval in the new metric as we move towards the center of the gravitational object. In this plot, we start at a distance of $R = 30\frac{GM}{c^2}$ and move inwards to $R = \frac{GM}{c^2}$.

7 Fully consistent with Minkowski spacetime?

Minkowski [27] spacetime is invariant and flat, unlike spacetime in general relativity theory, where spacetime itself is curved.

The spacetime interval in the Minkowski metric, denoted as ds^2, is typically different from zero. However, in our Newtonian metric, it is flat and always zero. The reason the spacetime interval is zero in the Newtonian spacetime metric is that events (effects) caused by gravity are always related to the speed of gravity which is identical to the speed of light light. This holds true even in Newtonian physics (see [24]). This is fully consistent with Minkowski spacetime when dealing with causal events caused by signals moving at the speed of light. In such cases, the ds^2 term in the Minkowski metric is always zero. Rindler [28, 29] (and perhaps others who showed the same long before him) demonstrated in 1960 that Minkowski spacetime can be simplified from:

$$ds^2 = c^2dt^2 - dx^2 - dy^2 - dz^2 \tag{45}$$

to

$$0 = c^2dt^2 - dx^2 - dy^2 - dz^2 \tag{46}$$

when dealing with light signals, and also in the moving system $dt'^2c^2 - dx'^2 - dy'^2 - dz'^2 = 0$. This implies that ds^2 in the Minkowski metric is always zero (in addition to being flat) when causal events are caused by something moving at the speed of light.

Minkowski spacetime represents a four-dimensional spacetime, with three spatial dimensions and one time dimension. In the case where we consider the simplified scenario of one dimension in space and time, we have the well-known relation

$$ds^2 = c^2dt^2 - dx^2 = c^2dt'^2 - dx'^2 \tag{47}$$

This relation is directly related to the Lorentz transformation, as shown by the following equations:

$$\begin{aligned} s^2 &= c^2t'^2 - x'^2 = c^2\left((t - \frac{v}{c^2}x)\gamma\right)^2 - ((x - vt)\gamma)^2 \\ s^2 &= c^2\left(\frac{t - \frac{x}{c^2}v}{\sqrt{1 - \frac{v^2}{c^2}}}\right)^2 - \left(\frac{x - tv}{\sqrt{1 - \frac{v^2}{c^2}}}\right)^2 \end{aligned} \tag{48}$$

Next, let's consider a scenario where we have two events that are separated by a distance x and are causally connected. For these two events to be causally linked, information needs to be transmitted between them. This could take the form of, for example, a bullet traveling from event one and hitting event two, or a sound signal. The signal moves at a speed $v_2 \leq c$ as observed from the reference frame in which x is at rest. Consequently, the time between the cause and effect of the two events is $t = \frac{x}{v_2}$. Additionally, we have a velocity v which represents the velocity of the frame in which x is at rest with respect to another reference frame. Based on this, we can derive the following equations:

$$
\begin{aligned}
s^2 &= c^2 t'^2 - x'^2 \\
s^2 &= c^2 \left((t - \frac{v}{c^2} x)\gamma \right)^2 - ((x - vt)\gamma)^2 \\
s &= c^2 \left(\frac{\frac{x}{v_2} - \frac{x}{c^2} v}{\sqrt{1 - \frac{v^2}{c^2}}} \right)^2 - \left(\frac{x - \frac{x}{v_2} v}{\sqrt{1 - \frac{v^2}{c^2}}} \right)^2
\end{aligned} \tag{49}
$$

The spacetime interval in Minkowski space-time is invariant because $s^2 = t'^2 c^2 - x'^2$ remains the same regardless of the reference frame from which it is observed. This property implies that the spacetime interval is observed to be constant. One way to comprehend why this is the case is by examining the following derivation:

$$
\begin{aligned}
s^2 = t'^2 c^2 - x'^2 &= c^2 \left(\frac{\frac{x}{v_2} - \frac{x}{c^2} v}{\sqrt{1 - \frac{v^2}{c^2}}} \right)^2 - \left(\frac{x - \frac{x}{v_2} v}{\sqrt{1 - \frac{v^2}{c^2}}} \right)^2 \\
&= \left(\frac{x \frac{c}{v_2} - x \frac{v}{c}}{\sqrt{1 - \frac{v^2}{c^2}}} \right)^2 - \left(\frac{x - x \frac{v}{v_2}}{\sqrt{1 - \frac{v^2}{c^2}}} \right)^2 \\
&= \frac{x^2 \frac{c^2}{v_2^2} - 2x^2 \frac{v}{v_2} + x^2 \frac{v^2}{c^2}}{1 - \frac{v^2}{c^2}} - \frac{x^2 - 2x^2 \frac{v}{v_2} + x^2 \frac{v^2}{v_2^2}}{1 - \frac{v^2}{c^2}} \\
&= \frac{x^2 \frac{c^2}{v_2^2} + x^2 \frac{v^2}{c^2} - x^2 + x^2 \frac{v^2}{v_2^2}}{1 - \frac{v^2}{c^2}} \\
&= \frac{x^2 \left(\frac{c^2}{v_2^2} + \frac{v^2}{v_2^2} - 1 + \frac{v^2}{c^2} \right)}{1 - \frac{v^2}{c^2}} \\
&= \frac{-x^2 \left(1 - \frac{v^2}{c^2} \right) \left(1 - \frac{c^2}{v_2^2} \right)}{1 - \frac{v^2}{c^2}} \\
&= x^2 \left(\frac{c^2}{v_2^2} - 1 \right)
\end{aligned} \tag{50}
$$

This is independent of the velocity of the frame v, making it an invariant spacetime interval, as expected. In the special case where the causal signal moves at the speed of light, $v_2 = c$, we observe that the spacetime interval becomes $s^2 = 0$. To further illustrate this point, we can examine the following derivation:

$$
\begin{aligned}
s^2 = t'^2 c^2 - x'^2 &= c^2 \left(\frac{t - \frac{x}{c^2} v}{\sqrt{1 - \frac{v^2}{c^2}}} \right)^2 - \left(\frac{x - tv}{\sqrt{1 - \frac{v^2}{c^2}}} \right)^2 \\
&= \left(\frac{tc - x \frac{v}{c}}{\sqrt{1 - \frac{v^2}{c^2}}} \right)^2 - \left(\frac{x - tv}{\sqrt{1 - \frac{v^2}{c^2}}} \right)^2 \\
&= \frac{t^2 c^2 - 2txv + x^2 \frac{v^2}{c^2}}{1 - \frac{v^2}{c^2}} - \frac{x^2 - 2xtv + t^2 v^2}{1 - \frac{v^2}{c^2}} \\
&= \frac{t^2 c^2 - 2txv + x^2 \frac{v^2}{c^2} - x^2}{1 - \frac{v^2}{c^2}} \\
&= \frac{c^2 t^2 (1 - \frac{v^2}{c^2}) - x^2 (1 - \frac{v^2}{c^2})}{1 - \frac{v^2}{c^2}} \\
&= c^2 t^2 - x^2
\end{aligned} \tag{51}
$$

This clearly demonstrates that the spacetime interval is invariant and the same in any frame in the Minkowski metric. The time interval t represents the duration between two events as observed in the rest frame. Let's assume that the causal signal between the two events moves at a velocity v_2, then we have:

$$\begin{aligned} ds^2 &= c^2t^2 - x^2 \\ ds^2 &= c^2\frac{x^2}{v_2^2} - x^2 \\ ds^2 &= x^2\left(\frac{c^2}{v_2^2} - 1\right) \end{aligned} \tag{52}$$

In the special case when the causal signal moves at the speed of light, $v_2 = c$, this means $ds^2 = x^2\left(\frac{c^2}{v_2^2} - 1\right) = x^2\left(\frac{c^2}{c^2} - 1\right) = 0$. Therefore, the spacetime interval is zero for causal signals moving at the speed of light.

This implies that v becomes irrelevant in the equation, and it is proven that the Minkowski spacetime interval is invariant. Regardless of the signal speed v_2 between two events, the spacetime interval remains the same from every reference frame.

Again let us look at the special case where the signal between the two causal events always moves at $v_2 = c$, the simplification is significant. In this special case, we have:

$$\begin{aligned} s^2 &= c^2t'^2 - x'^2 \\ s^2 &= c^2\left((t - \frac{v}{c^2}x)\gamma\right)^2 - ((x - vt)\gamma)^2 \\ s^2 &= c^2\left(\frac{t - \frac{x}{c^2}v}{\sqrt{1 - \frac{v^2}{c^2}}}\right)^2 - \left(\frac{x - tv}{\sqrt{1 - \frac{v^2}{c^2}}}\right)^2 \\ s^2 &= c^2\left(\frac{\frac{x}{v_2} - \frac{x}{c^2}v}{\sqrt{1 - \frac{v^2}{c^2}}}\right)^2 - \left(\frac{x - \frac{x}{v_2}v}{\sqrt{1 - \frac{v^2}{c^2}}}\right)^2 \\ s^2 &= \left(\frac{x\frac{c}{v_2} - x\frac{v}{c}}{\sqrt{1 - \frac{v^2}{c^2}}}\right)^2 - \left(\frac{x - x\frac{v}{v_2}}{\sqrt{1 - \frac{v^2}{c^2}}}\right)^2 \\ s^2 &= \left(\frac{x\frac{c}{c} - x\frac{v}{c}}{\sqrt{1 - \frac{v^2}{c^2}}}\right)^2 - \left(\frac{x - x\frac{v}{c}}{\sqrt{1 - \frac{v^2}{c^2}}}\right)^2 \\ s^2 = 0 &= \left(\frac{x\left(1 - \frac{v}{c}\right)}{\sqrt{1 - \frac{v^2}{c^2}}}\right)^2 - \left(\frac{x\left(1 - \frac{v}{c}\right)}{\sqrt{1 - \frac{v^2}{c^2}}}\right)^2 \\ s^2 = 0 &= \frac{x^2\left(1 - \frac{v}{c}\right)}{\left(1 + \frac{v}{c}\right)} - \frac{x^2\left(1 - \frac{v}{c}\right)}{\left(1 + \frac{v}{c}\right)} \\ s^2 = 0 &= x^2\left(1 - \frac{v^2}{c^2}\right) - x^2\left(1 - \frac{v^2}{c^2}\right) \\ s^2 = 0 &= c^2t^2\left(1 - \frac{v^2}{c^2}\right) - x^2\left(1 - \frac{v^2}{c^2}\right) \end{aligned} \tag{53}$$

That we can set $x^2 = c^2t^2$ is only because we assume causal events of interest are caused by signals moving at the speed of light (which is the case of cause and effect of gravity that we soon will come back to). Namely, in this case, the spacetime interval is always zero and naturally always invariant. This is not surprising. However, this is identical to the Newtonian metric, with the only exception that v is swapped with the escape velocity. Therefore, gravity can be seen as Minkowski spacetime where the frame velocity is swapped with the escape velocity. This is not in line with general relativity theory, where for some unknown reason, it has been decided that the spacetime interval itself ds should also change with velocity (gravitational field).

The Schwarzschild metric is given by (for the radial direction only):

$$s^2 = c^2t^2\left(1-\frac{2GM}{rc^2}\right) - x^2\left(1-\frac{2GM}{rc^2}\right)^{-1} \tag{54}$$

Since the escape velocity consistent with, and also derived from, the Schwarzschild metric is the well-known $v_e = \sqrt{\frac{2GM}{r}}$, we can replace $\frac{2GM}{r}$ in the Schwarzschild metric with v_e^2, and we get:

$$ds^2 = c^2dt^2\left(1-\frac{v_e^2}{c^2}\right) - dr^2\left(1-\frac{v_e^2}{c^2}\right)^{-1} \tag{55}$$

It looks almost identical to the Minkowski metric, but there is a major difference. In relation to dr^2, we have $\left(1-\frac{v_e^2}{c^2}\right)^{-1}$ instead of $\left(1-\frac{v^2}{c^2}\right)$. This is what makes the Schwarzschild metric have curved spacetime and not just curved space and time. Therefore, the Schwarzschild metric is never fully consistent with the Minkowski metric. It is only approximately consistent in the sense that ds^2 approaches zero and gives almost flat spacetime when $v_e \ll c$, which corresponds to $r \gg r_s$. Also we suspect that the curving of spacetime interval one get from general relativity theory mistakenly has been interpreted as a relativistic effect. It is clearly that the spacetime interval curves more for higher escape velocity inside general relativity theory, but this is in our view a mistake and has actually nothing to do with true relativistic effects in nature.

In the appendix we show a incorrect way to apply the Minkowski metric to the Schwarzschild metric, we do not try to hint that general relativity theory do this, they don't, but the appendix simply demonstrate a trap one easily can fall into if not being careful.

8 Wormholes are Forbidden

As early as 1916, Flamm [30] hinted at the possibility of wormholes. Later, in 1935, Einstein and Rosen [31] mathematically formulated the concept of wormholes using the Schwarzschild metric. For the sake of simplicity, we will use geometric units where $G = c = 1$ in this discussion. Consequently, the Schwarzschild radius becomes $r_s = \frac{2GM}{c^2} = 2m$.

Next, Einstein and Rosen introduced a new variable, $u^2 = r - 2m$, and substituted r with $u^2 + 2m$ in the Schwarzschild metric, resulting in:

$$\begin{aligned} ds^2 &= \left(1-\frac{r_s}{r}\right)c^2dt^2 - \frac{dr^2}{1-\frac{r_s}{r}} - r^2(d\theta^2+\sin^2\theta d\phi^2) \\ ds^2 &= -4(u^2+2m)du^2 - (u^2+2m)^2(d\theta^2+\sin^2\theta d\phi^2) + \frac{u^2}{u^2+2m}dt^2 \end{aligned} \tag{56}$$

Next, they examined the special case when $u = 0$. In this scenario, the term $g_{1,1} = \left(1-\frac{r_s}{r}\right)c^2dt^2 = \frac{u^2}{u^2+2m}dt^2$ vanishes, while the other terms in the Schwarzschild metric remain well-defined. This has been interpreted as the ability to move in space without experiencing the passage of time.

In our relativistic Newton metric, we have $r_c = \frac{GM}{c^2}$ when $v_e = c$. By utilizing the geometric unit system where $G = c = 1$, we can set $m = \frac{GM}{c^2}$. Similar to Einstein and Rosen, we set $u^2 = r - m$. The selection of u is consistent with the Einstein-Rosen solution, leading to the cancellation of the dt^2 term. Consequently, we can replace r with $r = u^2 + m$. This yields the following expression:

$$\begin{aligned} ds^2 &= \left(1-\frac{2GM}{rc^2}+\frac{G^2M^2}{r^2c^4}\right)c^2dt^2 - \left(1-\frac{2GM}{rc^2}+\frac{G^2M^2}{r^2c^4}\right)dr^2 - g_\Omega \\ ds^2 &= \left(\frac{u^2}{u^2+m}\right)^2dt^2 - \left(\frac{u^2}{u^2+m}\right)^2dr^2 - (u^2+m)^2(d\theta^2+\sin^2\theta d\phi^2) \end{aligned} \tag{57}$$

Now, if we set $u = 0$, not only does the dt term vanish, but the dr term does as well. Consequently, it is not possible to move solely in space without moving also in time. Wormholes are forbidden within the framework of relativistic Newtonian theory. They seem to be a prediction due to one not properly have taken into account relativistic effects.

9 Black hole information paradox likely removed

In the relativistic modified Newtonian model, the escape velocity is given by $v_e = \sqrt{\frac{2GM}{c^2 r} - \frac{G^2M^2}{c^2r^2}}$. The radius at which the escape velocity is equal to the speed of light is $r_c = \frac{GM}{c^2}$, in contrast to the Schwarzschild metric where it is $r_s = \frac{2GM}{c^2}$. It could be of interest to note that the relativistic Newtonian horizon corresponds to the horizon obtained in the extremal solution of the Reissner-Nordström metric [1,2] and the extremal solution of the Kerr metric, which likely results in the same escape velocity. However, the Reissner-Nordström and Kerr metrics are based on the general theory of relativity and therefore predict curved spacetime. In our Newtonian metric, the spacetime is flat and there is no singularity at the horizon $r_c = \frac{GM}{c^2}$. That we have no singularity at the horizon is a key to get rid off the black hole information paradox.

In the Schwarzschild metric, the escape velocity is equal to the speed of light at the event horizon and exceeds the speed of light inside the event horizon, there is also a singularity with infinite spacetime curvature at the horizon. In the relativistic Newtonian model, the escape velocity is equal to the speed of light at the horizon and always remains equal to or below the speed of light inside the black hole object.

Figure 3 illustrates the relativistic Newton escape velocity outside this type of black hole. As expected, the escape velocity is below the speed of light. Therefore, objects outside the black hole can naturally escape the gravitational forces of the black hole as long as they travel away from the black hole at a speed equal to or greater than the escape velocity

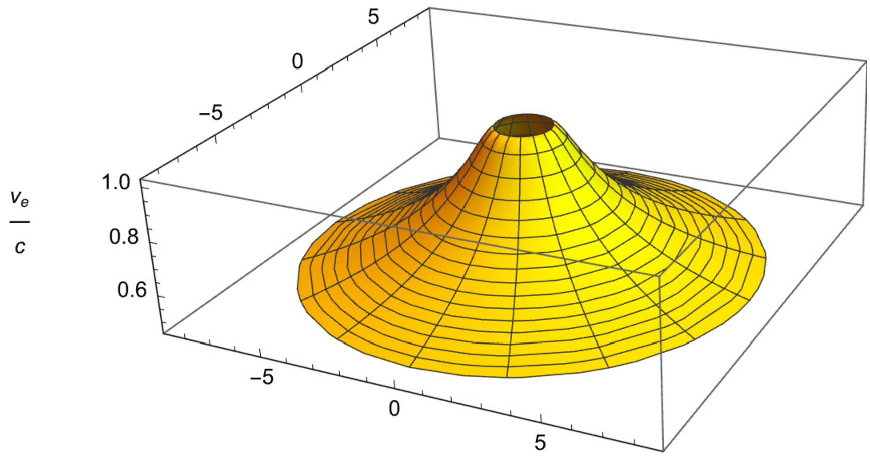

Figure 3: The figure illustrates the escape velocity on the outside of a black hole, as analyzed through the new Newtonian relativistic metric. It starts at $r = 8\frac{GM}{c^2}$ from the center of the black hole and radially moves inward to $r = \frac{GM}{c^2}$, where the escape velocity is c. The vertical axis represents $\frac{v_e}{c}$

Figure 4 shows that the escape velocity from the relativistic Newton metric inside a black hole It is always below c. This means that light potentially can escape this type of black hole, but anything with rest-mass cannot, so matter will fall into the black hole and light will be able to move out. However, this do not exclude that black holes are also dark, because remarkable also the orbital velocity is identical to the escape velocity at the radius where the escape velocity is c. That is we have $v_e = c = \sqrt{\frac{2GM}{r} - \frac{G^2M^2}{c^2r^2}} = \sqrt{\frac{GM}{r}} = v_o$ when $r = r_c = \frac{GM}{c^2}$. This means a large amount of pure energy (photons) could potentially also end up orbiting the black hole. This means the relativistic Newtonian metric is consistent with a rotating black hole. Here one even have a mechanism explaining what is meant by a rotating black hole object, it will simply mean a large amount of pure energy (photons) are orbiting at the horizon of the object. The closest we come in general relativity theory to this is likely the extremal case of the Kerr metric when $a = \frac{G^2M^2}{c^4}$. However in the Kerr metric the spacetime interval is infinite at the horizon so no light can escape a black hole in the Kerr metric, while in the relativistic Newton metric there is no singularity at the horizon and light can likely also escape.

Despite a considerably amount of pure energy (photons) could end up orbiting the black hole at $r = r_c = \frac{GM}{c^2}$, it is highly likely that light would still manage to escape from these objects since the escape velocity never goes above c, rendering the term "black hole" somewhat misleading. Consequently, one could anticipate that at least some black holes to be extraordinarily bright. Quasars appear to align with this expectation. Interestingly, actual photographs of quasars taken, for example, by the Hubble Telescope, exhibit a remarkably bright center of quasars,

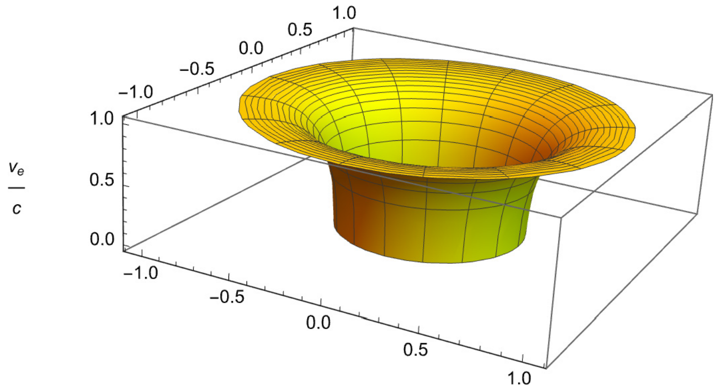

Figure 4: The figure illutrates the escape velocity from our new metric on the inside of a black hole starting at $r = r_h = \frac{GM}{c^2}$ from the center of the black hole and down and including $r = \frac{1}{2}\frac{GM}{c^2}$, the vertical axis is $\frac{v_e}{c}$. As we can see is the escape velocity dropping from c to zero inside the black hole. The escape velocity is never above c and therefore light can escape the black hole object.

while only artistic illustrations depict them as dark. Nonetheless, our model does not preclude them from being dark; at the very least, the photons orbiting the black hole at the event horizon would undoubtedly create significant disturbances in the immediate vicinity and could potentially impact the accretion disk, but the accretion disk is not needed to explain their brightness, as light likely also comes out from the black hole object itself.

According to conventional theory, the brightness of quasars (as well as other galaxy centres with black holes) is explained through accretion disk theory. However, based on this new metric, it is also possible that light emanates from within the black hole itself. The accretion disk theory and the idea of light originating from the inside of the black hole are not mutually exclusive; instead, they could complement one another. As predicted by the new metric, matter and energy would naturally continue to be influenced outside the black hole by such things as the gravitational acceleration.

Let us try to "enforce" faster than light escape velocity in the relativistic Newton metric. We can set up the following equation and solve with respect to what radius will correspond to $x > 1$,

$$xc = \sqrt{\frac{2GM}{r} - \frac{G^2M^2}{c^2r^2}} \tag{58}$$

Solved with respect to r gives

$$r = \frac{GM}{c^2x^2}(1 - \sqrt{1 - x^2}) \tag{59}$$

When $x > 1$, the resulting radius becomes imaginary (as we obtain the square root of a negative number). We believe that this should be interpreted as the impossibility of forcing the escape velocity to exceed the speed of light (c) when fully considering relativistic effects, that is, properly taking into account strong gravitational fields.

In the standard Schwarzschild metric, there is nothing that prevents the mass from collapsing into the central singularity (except perhaps in the Reissner-Nordström extremal solution where charge can potentially counteract the gravitational pull). Therefore, the interpretation in this metric is that all mass and energy that enters the black hole ends up in the central singularity. That is, all of the mass and energy of a Schwarzschild black hole is confined to a point with no spatial dimensions—the central singularity. No matter how absurd this may sound, that is what the standard Schwarzschild metric tells us. However, we believe that the Schwarzschild metric should never have been interpreted in the context of strong gravitational fields.

We can even find the maximum density inside the black hole if we interpret imaginary escape radiuses anywhere inside the black hole as not valid. We already know our escape velocity not will go above c. We can set up the following equation

$$c = \sqrt{\frac{2GM_i}{xr_c - \frac{G^2M_i^2}{c^2x^2r_c}^2}} \tag{60}$$

where M_i is the mass inside the radius $xr_c = x\frac{GM_{BH}}{c^2}$ where $x \leq 1$ and M_{BH} is the total mass in the whole black hole. This gives

$$M_i = xM_{BH} \text{ where } x \leq 1 \tag{61}$$

We can now plot the escape velocity inside the black hole in 3D by incorporating the additional boundary of the maximum mass density within the black hole. This is illustrated in Figure 5, which depicts the escape velocity from a radial distance of $r = 3\frac{GM}{c^2}$ to $r = l_p$. Outside the event horizon $r = r_c\frac{GM}{c^2}$, the escape velocity remains lower than c, but from the event horizon all the way to the center of the black hole, it is equal to c. Also before imposing this condition on mass density we had a maximum escape velocity of c, figure 4. The difference is our escape velocity now gives values all the way in to the very center $r = l_p$, while before looking into the maximum mass density implied by the model the escape velocity would give imaginary values inside $\frac{GM}{2c^2}$. Again keep in mind, that also the orbital velocity at the event horizon is c, which does not exclude black holes from appearing dark. Still it is highly likely that light will be able to escape simply as electromagnetic radiation, this finding has multiple important implications for unsolved problems the forefront of black hole research.

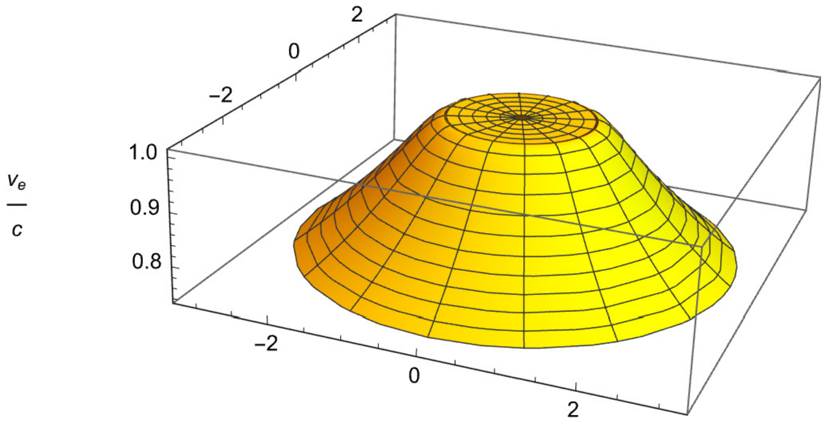

Figure 5: The figure illutrates the escape velocity from our new metric on the inside as well as on the outside of a black hole. The graph is starting at $r = 3\frac{GM}{c^2} = 3r_c$ from the center of the black hole and down and including $r = l_p$. Be aware that the radius where the escape velocity is c is at $\frac{GM}{c^2}$ and not at $\frac{2GM}{c^2}$ as is predicted in the standard Schwarzschild metric.The vertical axis is $\frac{v_e}{c}$. As we can see is the escape velocity is never above c inside the black hole and always below c outside the hole.

Our new interpretation of black holes stems from our understanding that their escape velocity differs from the standard (weak field) Schwarzschild metric. This interpretation is expected to have significant implications for the black hole information paradox put forward by Hawking [32]. While we do not attempt to solve the information paradox within the framework of general relativity theory, we assert that the paradox can be resolved for the black holes predicted by our metric. In this theory, the entire information paradox disappears as there is no singularity at the horizon, no infinite curved spacetime (spacetime is actually flat) and the escape velocity never goes above c.

It appears that photons can escape the black hole or, at the very least, become trapped on the surface of the black hole. Additionally, there is no singularity at the event horizon in the relativistic Newton metric.

Whether the black hole information paradox is truly resolved in the new metric should be thoroughly investigated, but it certainly appears that this may be the case.

10 Three or Four Dimensions?

In this paper, we have primarily focused on working in the radial directions, as well as in four-dimensional space-time. In four-dimensional space-time, our relativistic Newton metric would be expressed in spherical polar coordinates:

$$ds^2 = \left(1 - \frac{v_e^2}{c^2}\right)c^2dt^2 - \left(1 - \frac{v_e^2}{c^2}\right)dr^2 - r^2 g_\Omega \tag{62}$$

where $\Omega = (d\theta^2 + \sin^2\theta d\phi^2)$.

In the radial direction alone, the spacetime interval would always be zero. However, we strongly prefer the conservation of spacetime curvature. Various attempts have been made to explore theories with different numbers of dimensions compared to the standard four. Particularly intriguing is the concept of incorporating three time dimensions in addition to three spatial dimensions (see [33–37]).

In a recently introduced quantum gravity theory [38], which is fully consistent with the relativistic Newton spacetime metric in the radial direction, we propose that space and time are two aspects of the same entity, namely collision space-time. However, delving into this concept extensively in this paper would require many additional pages and divert the focus from the main topic, which is the derivation and comprehensive understanding of the cosmological constant from the relativistic Newtonian theory.

In three-dimensional spacetime, the relativistic Newton metric can be expressed as follows:

$$\begin{aligned} ds^2=0 &= \left(1-\frac{v_e^2}{c^2}\right)c^2dt^2+c^2t^2g_\Omega-\left(1-\frac{v_e^2}{c^2}\right)dr^2-r^2g_\Omega \\ ds^2=0 &= \left(1-\frac{2GM}{rc^2}+\frac{G^2M^2}{r^2c^4}\right)c^2dt^2+c^2t^2g_\Omega-\left(1-\frac{2GM}{rc^2}+\frac{G^2M^2}{r^2c^4}\right)dr^2-r^2g_\Omega \end{aligned} \tag{63}$$

Despite the presence of three time dimensions and three space dimensions, working with this theory is actually easier compared to four-dimensional spacetime. The reason for this is that in this particular theory, the dimensions of time and space are fully "correlated" at the quantum level. Therefore, even though we have a total of six dimensions (three in space and three in time), it is more accurate to consider it as a three-dimensional spacetime since they are interconnected aspects of the same entity.

11 Can the relativistic Newtonian theory stand up against observations and experiments?

An important test of any gravitational theory is whether it can withstand observations. The relativistic Newtonian modified model proposed by Bagge and Phipps in 1981 and 1986 was quickly criticized by Peters [39] due to its inability to accurately predict the precession of Mercury. Phipps [40] acknowledged this shortcoming. However, Corda [41] has recently demonstrated that by considering the mass of Mercury in relation to that of the Sun, along with relativistic effects, the modified Newtonian theory can accurately predict the precession of Mercury. In another paper, we discussed how the Bagge and Phipps model is designed for observing gravitational effects on small mass m from a large mass M. When observing the precession of Mercury, we find ourselves in a third frame (the Earth) where both Mercury (m) and the Sun (M) are moving relative to us. Taking this into account, it appears that the precession of Mercury can be explained simply by considering relativistic effects in Newtonian theory, as discussed in [42]. Recently, Vossoss, Vossos, and Massouros [43] suggested a new central scalar gravitational potential based on special relativity and Newtonian physics to explain the precession of Mercury. Drawing conclusions regarding these suggestions is beyond the scope of this discussion; it is still too early to determine whether relativistic Newtonian theory can fully explain the precession of Mercury. However, based on recent years' research, the possibility that relativistic modified Newtonian theory is consistent with Mercury's precession should certainly not be excluded yet.

Regarding gravitational redshift and gravitational time dilation, these phenomena have been measured with extremely high accuracy in weak gravitational fields, and the results align with predictions made by the Schwarzschild metric, as shown in [44]. Even in our weak field metric derived from Newton's theory, the time metric component is identical to that in the Schwarzschild metric time component g_{00}, and only the time component is utilized to make predictions for redshift and time dilation. Therefore, in the weak field regime, our theory predicts exactly the same gravitational redshift and gravitational time dilation as the Schwarzschild metric. This should not be surprising, as Adler, Bazin, and Schiffer [45] demonstrated in 1965, using a different approach, that Newton's theory in weak fields yields the same predictions for gravitational redshift as the general theory of relativity.

When it comes to light bending, it seems that our theory predicts the same behavior as the Schwarzschild metric in weak gravitational fields, specifically $\theta=\frac{4GM}{c^2r}$. However, in strong gravitational fields, our metric predicts a slight relativistic correction, resulting in $\theta=\frac{4GM}{c^2r}-\frac{2G^2M^2}{c^4r^2}$. For weak gravitational fields, such as light bending outside the Sun, the predictions of our theory and the Schwarzschild metric are indistinguishable. In fact, the weak field limit of our theory is identical to the redshift predicted by the Schwarzschild metric.

On the other hand, in a strong gravitational field, the predictions diverge. According to our relativistic model, light is completely bent around a spherical Planck mass particle, as well as around any black hole. This is consistent with the orbital velocity being equal to the escape velocity at the event horizon, indicating that light is bent and travels around the surface of the black hole. The Schwarzschild metric is not applicable for a Planck mass at the Planck length distance; it predicts that light is bent more than 360 degrees, which is impossible. These findings are in line with our comprehensive discussion on the Schwarzschild metric and micro black holes (refer to [20]).

There doesn't appear to be any observation or experimental research contradicting our theory. In addition we have recently presented evidence that relativistic Newtonian theory does not necessitate dark energy to make highly accurate predictions of Supernova 1a (refer to [12]). However, it is important to refrain from accepting these findings without question, despite the recent publication of much of this research. Examining a theory over time, with the involvement of multiple researchers, is typically required to thoroughly assess its validity. Nonetheless, we firmly believe that our theory exhibits sufficient potential to capture the interest of numerous researchers.

12 Quantum gravity rooted in the Planck scale

Even though this paper primarily focuses on how the cosmological constant appears to emerge from relativistic Newtonian theory, we will briefly mention how one can extend our theory to a quantum gravity theory of spacetime metric linked to the Planck scale (see also [38]). We must have:

$$\begin{aligned} ds^2 = 0 &= \left(1 - \frac{2GM}{rc^2} + \frac{G^2M^2}{r^2c^4}\right)c^2dt^2 + c^2t^2g_\Omega - \left(1 - \frac{2GM}{rc^2} + \frac{G^2M^2}{r^2c^4}\right)dr^2 - r^2g_\Omega \\ &= \left(1 - \frac{2l_p^2}{r\bar{\lambda}_M} + \frac{l_p^4}{r^2\bar{\lambda}_M}\right)c^2dt^2 + c^2t^2g_\Omega - \left(1 - \frac{2l_p^2}{r\bar{\lambda}_M} + \frac{l_p^4}{r^2\bar{\lambda}_M}\right)dr^2 - r^2g_\Omega \end{aligned} \tag{64}$$

Here, l_p represents the Planck length, and $\bar{\lambda}_M$ is the reduced Compton wavelength of the mass M. The Planck length can be determined independently of any knowledge of G, $\hbar$, and even c, contrary to previous assumptions (see [25, 46]). Similarly, the reduced Compton wavelength of any mass, including the entire mass of the universe, can also be found without relying on knowledge of G and $\hbar$. The aforementioned papers provide more information on this topic. While large composite masses do not possess a single Compton wavelength, the aggregate of the Compton wavelengths of the constituent parts forming the mass M can be directly determined using the method described in the aforementioned papers.

In the radial direction, we have the equation introduced in Section 4, given by $\Lambda_N + R_i - R_i g_m = \frac{8\pi G}{c^4}\rho_E$. This can be rewritten as:

$$\Lambda_N + R_i - R_i\left(1 - \frac{2l_p^2}{r\bar{\lambda}_M} + \frac{l_p^4}{r^2\bar{\lambda}_M^2}\right) = \frac{8\pi G}{c^4}\rho_E \tag{65}$$

We have recently [13, 38, 47] introduced what we call gravitational energy, which is defined as a collision length. The rest-mass gravitational energy is given by $E_g = l_p\frac{l_p}{\bar{\lambda}} = l_pP$, where l_p represents the Planck length, and P is the number of Planck events in the mass per Planck time. We can easily determine E_g from almost any gravitational observation without knowledge of G, the Joule energy, or the kilogram mass. For example, if we have measured the gravitational acceleration, then the gravitational energy is given by:

$$E_g = g\frac{r^2}{c^2} \tag{66}$$

This also implies that the relativistic Newtonian radial equation mentioned above can be rewritten as:

$$\Lambda_N + R_i - R_{im} = 8\pi\rho_g \tag{67}$$

Here, $\rho_g = \frac{E_g}{\frac{4}{3}\pi r^3}$ represents the gravitational energy density and g_m is the metric as before given by: $g_m = \left(1 - \frac{2GM}{c^2r} + \frac{G^2M^2}{c^2r^2}\right) = \left(1 - \frac{2l_p^2}{r\bar{\lambda}_M} + \frac{l_p^4}{r^2\bar{\lambda}_M^2}\right)$.

Alternatively equation 67 can also be expressed as:

$$\Lambda_N + R_i - R_i\left(1 - 2\frac{l_p}{r}\frac{\partial M_g}{\partial t} + \frac{l_p^2}{r^2}\frac{\partial^2 M_g}{\partial t^2}\right) = 8\pi\rho_g \tag{68}$$

In the above equation, M_g denotes the collision-time mass or gravitational mass, which is equal to $\frac{GM}{c^3} = t_p \frac{l_p}{\lambda} = t_p P$. Additionally, $\Lambda_N = 3\frac{l_p^2}{r^4}\frac{\partial^2 M_g}{\partial t^2}$ and $R_i = \frac{3}{r^2}$ represent the Gauss curvature (three times the Gauss curvature or alternatively $\frac{3}{2}$ times the Ricci curvature.).

Naturally, we do not expect the reader to accept any of these concepts unquestioningly. Instead, we encourage each individual to independently investigate these matters, engage in discussions, and collectively seek the best model to describe reality.

13 Conclusion

We have demonstrated that the standard Newtonian theory can be rewritten in a form that strongly reminds us of Einstein's field equation. However, it is still a very different equation without tensors. We have shown how the cosmological constant simply emerges when taking into account relativistic effects in Newtonian theory. Non-relativistic Newtonian theory seems to yield a metric similar to the Schwarzschild metric, except that the spacetime interval is always flat. This metric is only valid for weak gravitational fields. In strong gravitational fields, one needs to consider relativistic effects in Newtonian theory, leading to a strong field metric (holding in weak and strong fields). The strong field metric produces indistinguishable predictions from general relativity when working in weak field, such as gravitational time dilation, gravitational redshift, and gravitational bending of light. However, in strong gravitational fields, particularly for black holes, our theory provides significantly different predictions. The black hole information paradox proposed by Hawking seems to be resolved in this model. Furthermore, our theory predicts the conservation of spacetime, which is in stark contrast to general relativity. General relativity is supposedly consistent with the conservation of energy (as our theory is), but it predicts that the universe started with infinite spacetime curvature and will ultimately end up in basically flat spacetime. How is it possible to obtain something for nothing?

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Appendix: Mistaken analogy between Minkowski metric and Schwarzschild metric

We will also demonstrate an incorrect "heuristic" approach to obtaining the Schwarzschild metric from Minkowski spacetime. Minkowski spacetime is given by

$$ds^2 = c^2 dt'^2 - dx'^2 - dy'^2 - dz'^2 \tag{69}$$

One could mistakenly claim

$$dt' = dt\sqrt{1 - \frac{v^2}{c^2}} \tag{70}$$

and

$$dx' = \frac{dx}{\sqrt{1 - \frac{v^2}{c^2}}} \tag{71}$$

These formulas represent time dilation and length contraction, which are not identical to the time transformation and length transformation that are needed. If one mistakenly incorporates time dilation and length contraction into Minkowski spacetime, the resulting expression is:

$$ds^2 = \left(1 - \frac{v^2}{c^2}\right) c^2 dt^2 - \left(1 - \frac{v^2}{c^2}\right)^{-1} dx^2 - dy'^2 - dz'^2 \tag{72}$$

Then, by replacing v with the escape velocity $v_e = \sqrt{\frac{2GM}{r}}$, we obtain:

$$ds^2 = \left(1 - \frac{2GM}{rc^2}\right) c^2 dt^2 - \left(1 - \frac{2GM}{rc^2}\right)^{-1} dx^2 - dy'^2 - dz'^2 \tag{73}$$

Next, we rewrite it in spherical polar coordinates and obtain:

$$ds^2 = \left(1 - \frac{2GM}{rc^2}\right) c^2 dt^2 - \left(1 - \frac{2GM}{rc^2}\right)^{-1} dx^2 - r^2 g_\Omega \tag{74}$$

This expression appears to be identical to the Schwarzschild metric, which may lead one to mistakenly believe that it has been derived heuristically from simple logic. However, a major mistake is made in claiming that $dx' = \frac{dx}{\sqrt{1-\frac{v^2}{c^2}}}$ without utilizing the full Lorentz transformation to determine it. When done correctly, we would have:

$$ds^2 = \left(1 - \frac{v^2}{c^2}\right) c^2 dt^2 - \left(1 - \frac{v^2}{c^2}\right) dx^2 - dy'^2 - dz'^2 \tag{75}$$

By substituting the escape velocity $v_e = \sqrt{\frac{2GM}{r}}$ for v and rewriting it in spherical polar coordinates, we obtain:

$$ds^2 = 0 = \left(1 - \frac{2GM}{rc^2}\right) c^2 dt^2 - \left(1 - \frac{2GM}{rc^2}\right) dx^2 - r^2 g_\Omega \tag{76}$$

This is not the Schwarzschild metric, but rather our Newtonian spacetime metric when assuming 4-dimensional spacetime.