A different approach to relativistic gravity and expansion of the universe using no other constants than G and C

Author: Olov Nilsson

Abstract

It is self-evident that no knowledge of or surroundings can exist without observations from us or our fellows. This knowledge can of course be transferred to others, changing the context in which we perceive and understand our universe. I use the idea that both velocity and gravity can be described as a “potential for observation”, for a lack of better vocabulary. With the function *f(x)=(1/x)* and the inverse of the derivative of the Lorentz transformation, both Einsteinian kinetic energy and relativistic gravity can be computed. With the constants *c* and *G*, it is possible to construct a version of postnewtonian relativistic gravity, consistent with basic parts of Einstein's theory, but also suggesting a calculation of the expanding universe, deduction of an exact value of the Hubble constant, with no other constants involved than *c* and *G*.

Introduction

This paper works with the idea that the formulations of physics is a just systematization of observations and the likeliness of them, and is not primarily focused on building a model of reality. An attempt to reformulate Einstein's equation for kinetic energy E_k to a function for “potential for observation” which is the inversion of f(x)=1/x, minus a function for “basal potential for observation”, derived from the inversion of the derivative of the Lorentz transformation.

This function of basal probability can then be used in a 1/x formulation of postnewtonian gravity that can accurately predict the increased gravity for objects in orbit around the sun, including doubled gravity of photons passing the sun. This formulation can also be used to compute the expansion of the universe including correct values of zero-gravity corresponding to a stationary state R_{stat} (when acceleration from gravity-acceleration of expansion = 0) and a value of a Hubble constant (2.22344*10^{-18}/s).

Kinetic energy

Newtonian kinetic energy can be defined from a 1/v function of "potential for observation", for lack of better vocabulary. The longer between observations the more energy is required to compensate for falling potential. This compensation is v and the kinetic energy is the integral of the compensation: $v^2/2$.
The same maneuver for Einsteinian E_k means taking the Lorentz transformation, differentiate it in respect to v, taking the inverse and factorizing out 1/v. Below is the factorized inverse of the derivative of the Lorentz transformation, where also the factor c^2 has been excluded and treated as implicit in mass(temporally put back in equation E_3).

Inverse of derivative:

$$\frac{c^2\left(\left|1-\frac{x^2}{c^2}\right|^{1.5}\right)}{x}$$

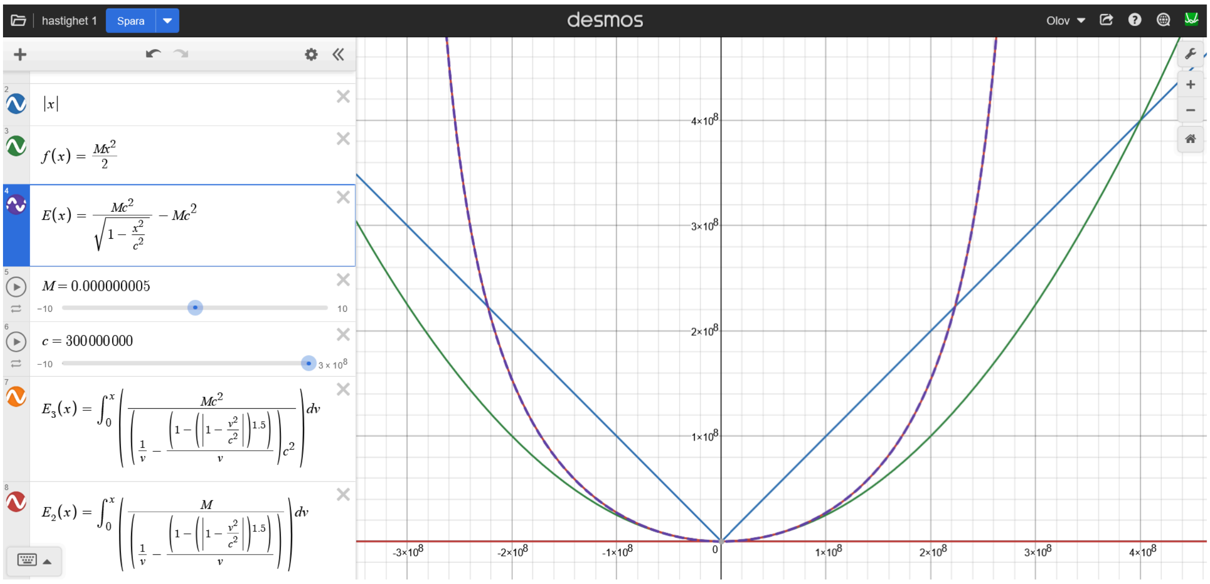
Inverse derivative with 1/v factorized out, factor c^2excluded:

$$\frac{\left(1-\left|1-\frac{(v)^2}{c^2}\right|^{1.5}\right)}{v}$$

The complete expression:

$$\left(\frac{1}{v}-\frac{\left(1-\left(\left|1-\frac{v^2}{c^2}\right|\right)^{1.5}\right)}{v}\right)$$

The integrals are below:



So $E2$ and $E3$ integrals over x are equal to E.

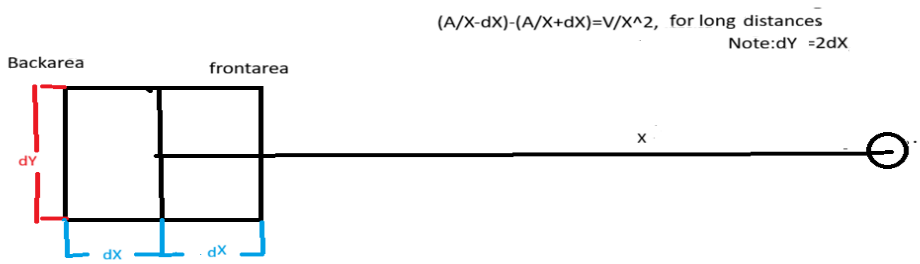
The reason for this "shuffling" of figures is to obtain a "base potential for observation" relating to speed=

$$\frac{\left(1-\left|1-\frac{(v)^2}{c^2}\right|1.5\right)}{v}$$

Thus in the case of velocity, "base potential" is treated like "noise" for observation, to be subtracted from "signal".
Further on we will use modification of this base potential for gravitation.

Gravity

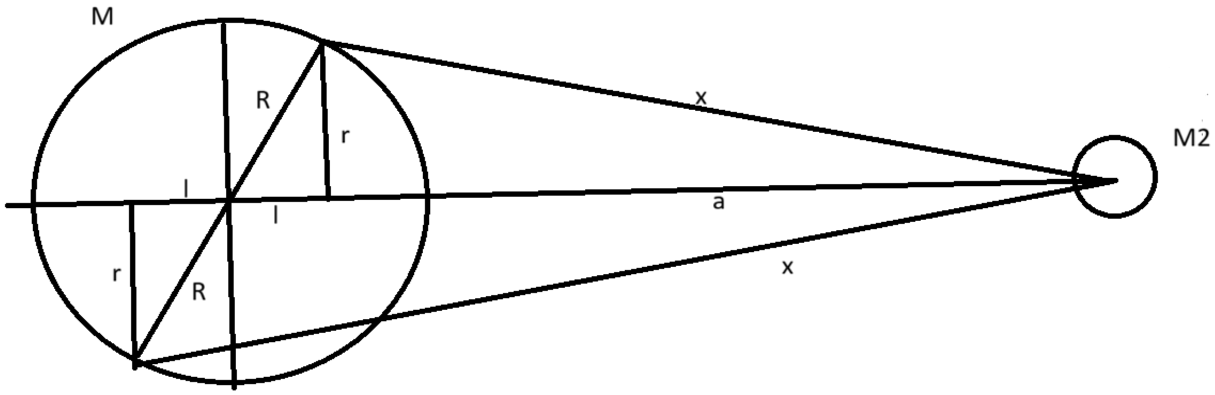
To continue we need an 1/x based gravity function. To accomplish this we look to surfaces instead of centers of mass. A simplified view of this that will suffice approximately on large distances is for example a cube or cylinder, with the same volume as a sphere.



In the case of cylinder $\Pi R^2/(x - \Delta x)$-$\Pi R^2/(x + \Delta x)$ will be very close if Δx is defined as :

Δx=$- 3x + \sqrt{9x^4 + 16x^2 r^2}$ derived from $\Pi R^2/(x - \Delta x)$-$\Pi R^2/(x + \Delta x)$=$4\Pi R^3/3x^2$.

In the case of a sphere:



$Sum\ of\ \Delta area(ie\ circumference)/distance(x)\ -\ sum\ of\ \Delta backarea(ie\ circumference/distance(x)$

$= \int_0^R 2\Pi r/\sqrt{(a - \sqrt{R^2 - r^2}\ )^2 + r^2}$ - $\int_0^R 2\Pi r/\sqrt{(a + \sqrt{R^2 - r^2})^2 + r^2}$,

This is equal with $4\Pi R^3/3a^2$=V/a^2.

If multiplying with another mass, you have to multiply the product with a^2(M/a^2*m/a^2) to achieve Mm/a^2.

This can also be shown by finding the primitive functions with the same interval R to 0 and subtracting front from back.

$$\int \frac{2\pi z}{\sqrt{\left(a-\sqrt{R^2-z^2}\right)^2+z^2}}\,dz = \frac{2\pi\sqrt{a^2-2a\sqrt{R^2-z^2}+R^2}\left(a^2+a\sqrt{R^2-z^2}+R^2\right)}{3a^2} + \text{constant}$$

front R→ 0 (Wolfram)

minus

$$\int \frac{2\pi z}{\sqrt{\left(a+\sqrt{R^2-z^2}\right)^2+z^2}}\,dz = \frac{2\pi\left(a^2-a\sqrt{R^2-z^2}+R^2\right)\sqrt{a^2+2a\sqrt{R^2-z^2}+R^2}}{3a^2} + \text{constant}$$

back R→ 0 (Wolfram)

Simplification of this will give $4\Pi R^3/3a^2$. $r = z = integration\ variable,\ see\ picture\ above.$

Now the complete equation will be ("a" has been substituted for x in the following):

$$g_9(x) = Gx^2\left|\left|\left(\left(\left(\left(\int_0^r \frac{p2\pi z}{\sqrt{\left(x-\sqrt{r^2-z^2}\right)^2+z^2}}\,dz\right)-\left(\int_0^r \frac{p2\pi z}{\sqrt{\left(x+\sqrt{r^2-z^2}\right)^2+z^2}}\,dz\right)\right)\right)\right)\left(\left|\left(\left(\int_0^{r_7} \frac{p_7 2\pi z}{\sqrt{\left(x-\sqrt{r_7^2-z^2}\right)^2+z^2}}\,dz\right)-\left(\int_0^{r_7} \frac{p_7 2\pi z}{\sqrt{\left(x+\sqrt{r_7^2-z^2}\right)^2+z^2}}\,dz\right)\right)\right|\right)\right|$$

Which is equal to

$$g(x) = \frac{G\left(\frac{4\pi r^3 p}{3}\right)\left(\frac{4\pi r_7^3 p_7}{3}\right)}{x^2}$$

p = density, not pressure.

Next we proceed with this gravitation formula, using our earlier function for speed:

$$\left(\frac{1}{v} - \frac{\left(1-\left(\left|1-\frac{v^2}{c^2}\right|\right)^{1.5}\right)}{v}\right)$$

Multiply with 1/t for v→ $s(distance)$ but instead of subtracting "base potential" we make, in the case of gravity, an addition, thus treated like an "enhancement of signal".

$$\frac{1}{x} + \frac{\left(1-\left(\left|1-\frac{v^2}{c^2}\right|\right)^{1.5}\right)}{x}$$

Again substitute x according to figures above x⇒ $\sqrt{(x-\sqrt{R^2-r^2})^2+r^2}$

So we now add the results from the two functions of gravity: the function 1/x and the “base potential of gravity”.

Result:

$$o_9 = Gx^2\left(\left(\left(\int_0^r \frac{p2\pi z}{\sqrt{(x-\sqrt{r^2-z^2})^2+z^2}}dz\right)-\left(\int_0^r \frac{p2\pi z}{\sqrt{(x+\sqrt{r^2-z^2})^2+z^2}}dz\right)\right)\right)\left(\left(\left(\int_0^{r_7} \frac{p_7 2\pi z}{\sqrt{(x-\sqrt{r_7^2-z^2})^2+z^2}}dz\right)-\left(\int_0^{r_7} \frac{p_7 2\pi z}{\sqrt{(x+\sqrt{r_7^2-z^2})^2+z^2}}dz\right)\right)+\left(\left(\int_0^{r_7} \frac{p_7 2\pi z\left(1-\left(1-\frac{v^2}{c^2}\right)^{1.5}\right)}{\sqrt{(x-\sqrt{r_7^2-z^2})^2+z^2}}dz\right)-\left(\int_0^{r_7} \frac{p_7 2\pi z\left(1-\left(1-\frac{v^2}{c^2}\right)^{1.5}\right)}{\sqrt{(x+\sqrt{r_7^2-z^2})^2+z^2}}dz\right)\right)\right)$$

or:

$$g_9(x) = \frac{G\left(\left(\frac{4\pi r^3 p}{3}\right)\left(\frac{4\pi r_7^3 p_7}{3}+\frac{4\pi r_7^3 p_7}{3}\cdot 2\left(1-\left(1-\frac{v^2}{c^2}\right)^{1.5}\right)\right)\right)}{x^2}$$

after simplifying and factorization. I am uncertain about the factor 2, but believe it is because $\Delta dY = 2\Delta x$, look at the figure cube/cylinder above. To divide the extra factor on the sun and planet as a reciprocal phenomenon, gives almost identical results.

$$g_7(x) = \frac{G\left(\left(\frac{4\pi r^3 p}{3}+\frac{4\pi r^3 p}{3}\left(1-\left(1-\frac{v^2}{c^2}\right)^{1.5}\right)\right)\left(\frac{4\pi r_7^3 p_7}{3}+\frac{4\pi r_7^3 p_7}{3}\cdot\left(1-\left(1-\frac{v^2}{c^2}\right)^{1.5}\right)\right)\right)}{x^2}$$

What we lose with going from integral to primitive function is that O_9 is identical to Newton's formula until x=radius of sphere but goes to 0 when x=0. With $g_{9 \text{ and } 7}$ the problem with infinite gravity when x=0 occurs.

g_9 gives the same enhancement of “gravity” we see in Einstein's formula with respect to velocity in circular orbit. Comparison to $3GM/c^2x$ as accepted postnewton addition (NSA reference among others)

Earth: (Desmos)

$$g_7(x) = \frac{G\left(\left(\frac{4\pi r^3 p}{3}\right)\left(\frac{4\pi r_7^3 p_7}{3}+\frac{4\pi r_7^3 p_7}{3}\cdot 2\left(1-\left(1-\frac{v^2}{c^2}\right)^{1.5}\right)\right)\right)}{x^2}$$

$$\frac{g_7(1.5\cdot 10^{11})}{g(1.5\cdot 10^{11})} = 1.00000002949$$

$$1+\frac{3G\frac{4\pi r^3 p}{3}}{c^2\cdot 1.5\cdot 10^{11}} = 1.00000002949$$

Mercury.

$$g_7(x) = \frac{G\left(\left(\frac{4\pi r^3 p}{3}\right)\left(\frac{4\pi r_7^3 p_7}{3} + \frac{4\pi r_7^3 p_7}{3} \cdot 2\left(1 - \left(1 - \frac{v^2}{c^2}\right)^{1.5}\right)\right)\right)}{x^2}$$

$$v = \sqrt{\frac{G\frac{4\pi r^3 p}{3}}{|x|}}$$

$$\frac{g_7(58 \cdot 10^9)}{g(58 \cdot 10^9)}$$

$= 1.00000007628$

$$1 + \frac{3G\frac{4\pi r^3 p}{3}}{c^2 \cdot 58 \cdot 10^9}$$

$= 1.00000007628$

v= orbit velocity.
For v=c, photons (with no resting mass) we get double gravity, possibly corresponding to double sun lensing compared to Newton. For matter(resting mass)near the speed of light, it seems like it would triple? How would that affect dark matter calculations, in particular if other velocities than in orbits are included. Objects far away, moving faster away would have higher gravitation, affecting Hubble values(Hubble tension)? Very speculative though. Of course I do not have the needed calculating skills.

(For an elliptic orbit of Mercury, substitute distance in the equation? (Have not tried)
$\rightarrow a(1 - e^2)/(1 + e\cos(\theta))$, $where\ e = (r\alpha - r\rho)/(r\alpha + r\rho)$,
$r\alpha = apoapsis\ and\ r\rho = periapsis$.)

Far from the sun, velocity of orbit goes toward 0.

$$v = \sqrt{\frac{G\frac{4\pi r^3 p}{3}}{|x|}}$$

From:

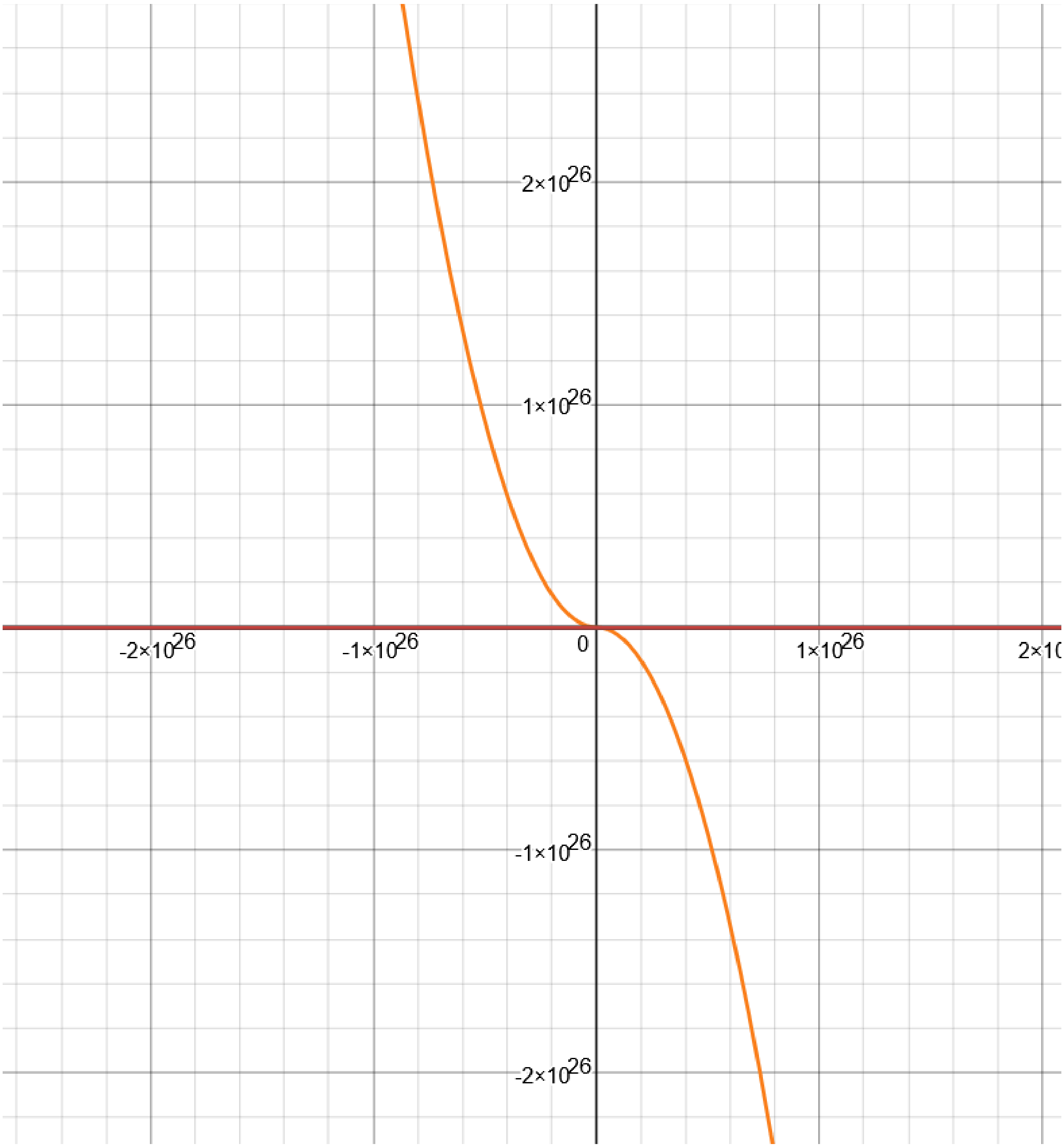
$$\frac{GMm}{x^2} = \frac{mv^2}{x}$$

To look at far distances we again use the same shape of "base potential of observation" and multiply the remaining v and c again with1/t, for:

$$\frac{\left(1-\left|1-\frac{(x)^2}{c^2}\right|^{1.5}\right)}{x}$$

c will in this be $3 * 10^8$m, not velocity, constituting a third perspective of "base potential of observation".

This gives a third part of the function for gravity, or with properties of expansion if you choose that semantic, that grows more negative with distance(below). Note that this part of the function is not multiplied with the mass of the sun, but merely added to follow what happens with the "base potential of observation" in the far distance, not related to speed and when the influence of the sun is negligible:
(Desmos)



This function accelerates fast negatively towards $1 * 10^{26}$. However, it does not reach a finite limit.

If we add this third function to the equations above:

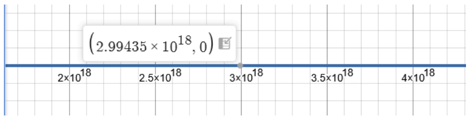
$$g_9(x) = \frac{G\left(\left(\frac{4\pi r^3 p}{3}\right)\left(\frac{4\pi r_7^3 p_7}{3} + \frac{4\pi r_7^3 p_7}{3} \cdot 2\left(1 - \left(1 - \frac{v^2}{c^2}\right)^{1.5}\right)\right)\right) + 2\left(\frac{G4\pi r_7^3 p_7}{3}\left(\left(1 - \left(\left|1 - \frac{x^2}{c^2}\right|\right)^{1.5}\right)\right)\right)}{x^2}$$

or

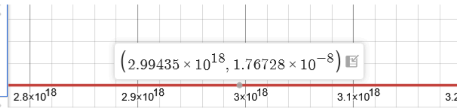
$$g_7(x) = \frac{G\left(\left(\frac{4\pi r^3 p}{3}\right)\left(\frac{4\pi r_7^3 p_7}{3} + \frac{4\pi r_7^3 p_7}{3}\cdot 2\left(1-\left(1-\frac{v^2}{c^2}\right)^{1.5}\right)\right)\right)}{x^2} + \frac{G4\pi r_7^3 p_7}{3}\left(\frac{\left(\left|1-\frac{(x)^2}{c^2}\right|^{1.5}-1\right)}{x^2} + \frac{\left(3c^2-3x^2\right)}{c^4\sqrt{\left|1-\frac{x^2}{c^2}\right|}}\right)$$

interesting things happen.
g_9 is in analogy of earlier equations, g_7 is the same thought but computed with the derivative of the “base potential” as the constant of the curve at x multiplied with mass.
The complete formula now grows increasingly negative towards distant x.
From this final formula you find 0-gravity at x=
(Wolfram,Desmos)

$$g_7(x) = \frac{G\left(\left(\frac{4\pi r^3 p}{3}\right)\left(\frac{4\pi r_7^3 p_7}{3} + \frac{4\pi r_7^3 p_7}{3}\cdot 2\left(1-\left(1-\frac{v^2}{c^2}\right)^{1.5}\right)\right)\right)}{x^2} + \frac{G4\pi r_7^3 p_7}{3}\left(\frac{\left(\left|1-\frac{(x)^2}{c^2}\right|^{1.5}-1\right)}{x^2} + \frac{\left(3c^2-3x^2\right)}{c^4\sqrt{\left|1-\frac{x^2}{c^2}\right|}}\right)$$



$$g_9(x) = \frac{G\left(\left(\frac{4\pi r^3 p}{3}\right)\left(\frac{4\pi r_7^3 p_7}{3}+\frac{4\pi r_7^3 p_7}{3}\cdot 2\left(1-\left(1-\frac{v^2}{c^2}\right)^{1.5}\right)\right)+2\left(\frac{G4\pi r_7^3 p_7}{3}\left(\left(1-\left(\left|1-\frac{x^2}{c^2}\right|\right)^{1.5}\right)\right)\right)\right)}{x^2}$$



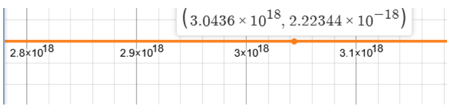
R_{stat}=a_e(acceleration of expansion)-a_g(acceleration of gravity)=0
$Rstat\colon GM/x^2 - H^2x. \Rightarrow x = \sqrt[3]{GM/H^2} = 2.83 * 10^{18} - 3.08 * 10^{18}m$, depending on measurement of H, well in alignment of equations above, and notably without other constants than c and G. This assumes that H is constant or near-constant in time.

Further we can compute a value for the Hubble constant:

$$H = \sqrt{\frac{\left(\frac{-g_7(x)}{\frac{4\pi r_7^3 p_7}{3}} + \frac{G4\pi r^3 p}{3x^2}\right)}{|x|}}$$

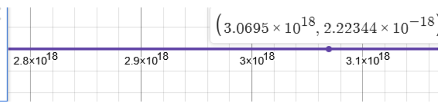
Calculated from $Ftot(g7)/m = - H^2x + Gm/x^2$.

$$H = \sqrt{\frac{\left(\frac{-g_7(x)}{\frac{4\pi r_7^3 p_7}{3}} + \frac{G4\pi r^3 p}{3x^2}\right)}{|x|}}$$



This is almost the same as:

$$H_1 = \sqrt{\frac{-2\left(\left(1-\left(\left|1-\frac{x^2}{c^2}\right|\right)^{1.5}\right)\right)G}{x^3}}$$



if we ignore the second part of function concerning velocity, also well consistent with measurements($2.17 * 10^{-18} - 2.4 * 10^{-18}$).

H_1 has the same value regardless of the value of x from about $1 * 10^{11}$m and distant. . H is constant from $5 * 10^{15}$and distant, decreases to 0 at $5.87 * 10^{14}$ and has no real values closer to zero, if we do not use absolute values. If we keep the velocity-depending second part in H_1 the functions seem identical.

$$H_2 = \sqrt{\frac{-2\left(\left(1-\left(\left|1-\frac{x^2}{c^2}\right|\right)^{1.5}\right)\right)G}{x^3} - \frac{G\left(\frac{4\pi r^3 p}{3}\cdot 2\left(1-\left(1-\frac{v^2}{c^2}\right)^{1.5}\right)\right)}{x^3}}$$

The Hubble sphere radius c/H will be 1.34926* 10^{26}m with this Hubble value(c=$3 * 10^8$m). Note that with this computation, if no further factors are included, the Hubble tension can only be explained with a variation of constants c or G between the near and the far universe, or possible effect of triple gravity for objects moving fast away(very speculative).

Thoughts about Schwarzschild radius etc.

I have some uncertain thoughts about how this relates to Schwarzschild's radius, the photon sphere etc.
I am not a mathematician, nor a physicist and definitely not a scientist, merely a general practitioner of medicine. I do not know if this is significant or only numerology and coincidental: If $g_7(x)$ describes a summation of relativistic gravity and centrifugal acceleration we can make the equation below

$$g_{7mod}(x): \frac{G\left(\frac{4\pi r^3 p}{3}\cdot\frac{4\pi r_7^3 p_7}{3}\left(1+2\left(1-\left(1-\frac{v^2}{c^2}\right)^{1.5}\right)\right)\right)}{x^2\frac{4\pi r_7^3 p_7}{3}} = \frac{v^2}{x}$$

Further simplification and solving for x when v=c, will give x=$3GM/c^2$, i.e. photon sphere radius.
Furthermore the same for flight radius:

$$g_{7mod}(x): \frac{G\left(\frac{4\pi r^3 p}{3}\cdot\frac{4\pi r_7^3 p_7}{3}\left(1+2\left(1-\left(1-\frac{v^2}{c^2}\right)^{1.5}\right)\right)\right)}{x^2\frac{4\pi r_7^3 p_7}{3}}x = \frac{1}{2}\frac{4\pi r_7^3 p_7}{3}v^2$$

Solving for x when v=c, will give $6GM/c^2$ i.e. smallest stable orbit radius for matter
Finally $GMmx/x^2 = mv^2/2$ (the resting mass part of g7), give in the classical way when v=c, x=$2GM/c^2$= Schwarzschild radius.

Addendum:

Constants on page 7. Note c=$3 * 10^8 m$. Correction for this to c=2.99792458* $10^8 m$ will for example give H1=$2.2258 * 10^{-18}/s$ and Hubble sphere radius =$1.346895 * 10^{26} m$.

Interesting numerology:

Note also that the third addition for gravitation if x=c, gives the expression for Schwarzschild radius, c in this case $3 * 10^8 m$:

$$G\frac{4\pi r_7^3 p_7}{3}\cdot\frac{2\left(1-\left(1-\frac{c^2}{c^2}\right)^{1.5}\right)}{x^2}=\frac{2Gm}{c^2}$$

If we convert by dividing mass, and invert $c^2/2G = 6.7425831585 * 10^{26}$,(mass to radius ratio for a black hole)

which evens out if we add the baseline function

$$b(x)=\frac{\left(1-\left|1-\frac{(x)^2}{c^2}\right|^{1.5}\right)}{x}$$

for b(Hubble sphere radius) we get

$b\left(1.3492606052\cdot 10^{26}\right)$

$= -6.7426080768 \times 10^{26}$

Correction for c=2.99792458* $10^8 m$ and G=6.6743015* 10^{-11} and Hubble sphere radius= $1.346895 * 10^{26}$ will give:

$$b(1.346895 \cdot 10^{26}) = -6.7329497412 \times 10^{26}$$

and

$$\frac{c^2}{2G} = 6.7329530943 \times 10^{26}$$

So the **mass to radius ratio** for a black hole gives the same but negative value as our "base line potential" equation gives for x= Hubble sphere radius.

The Beginning and the End

Summary

So we find that it is possible to compute a postnewtonian, relativistic gravity function consisting of "potential of observation" in three parts, 1/x and two variations of the inverse of the derivative of Lorentz transformation, added as an "enhancement of signal for observation". This gravity function also describes an expansion of the universe as a result of negative gravity in the far distance. It is also consistent with special relativity for velocity if "base potential" is subtracted as "noise" . O_9 has been difficult to complete and evaluate with the third part of the equation, maybe due to numerical problems in graph computation. Maybe this could be an easier approach than using the field equations in some scenarios.

Olov Nilsson
General practitioner of medicine

References: **"Die Feldgleichungen der Gravitation" 1915**
"Den moderna fysikens grunder, från mikrokosmos till makrokosmos" studentlitteratur 1995
Evidence of a decreasing trend for the Hubble constant
A&A 230529
NASA: Comparison of Relativistic Effects (PDF)

$r = 695\,700\,000$

-10 6.957×10^{8}

$r_2 = 6\,371\,000$

-10 6371000

$p = 1\,410$

-10 1410

$p_2 = 5\,150$

-10 5150

$G = 6.674 \cdot 10^{-11}$

$= 6.674 \times 10^{-11}$

$c = 300\,000\,000$

-10 3×10^{8}

$r_3 = 2.439700 \cdot 10^{6}$

$= 2\,439\,700$

$p_3 = 5\,427$

-10 5427

$r_7 = r_2$

$= 6\,371\,000$

$p_7 = p_2$

$= 5\,150$