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In this document, the universe is considered a glome, see
http://henk-reints.nl/astro/HR-Geometry-of-the-Universe-v2b-20200625T0907Z.pdf.

Hubble constant

In this document, the *Hubble constant* is presumed to be $H_0 = 71$ km/s/Mpc, yielding $t_H = 13.77$ Ga.

***Mass* of the universe**

Subaru Deep Field:

object count:	N_{SDF}	$= 1\,400\,107$	
area:	$\Omega_{SDF} = 30' \times 37'$	$= 9.39 \times 10^{-5}$	sr
estim. full sky count:	$4\pi \cdot \frac{N_{SDF}}{\Omega_{SDF}}$	$\approx 1.87 \times 10^{11}$	

Hubble Ultra Deep Field:

object count:	N_{HUDF}	$= 10\,040$	
area:	$\Omega_{HUDF} = 2.4' \times 2.4'$	$= 4.87 \times 10^{-7}$	sr
estim. full sky count:	$4\pi \cdot \frac{N_{HUDF}}{\Omega_{HUDF}}$	$\approx 2.59 \times 10^{11}$.	

Estimated mean full sky object count:

arithmetic:	$N_{\text{🌀}} = \frac{1.87+2.59}{2} \times 10^{11}$	$= 2.23 \times 10^{11}$
geometric:	$N_{\text{🌀}} = \sqrt{1.87 \times 2.59} \times 10^{11}$	$= 2.20 \times 10^{11}$.

Estimated average galaxy *mass*:

mass of Milky Way:	M_{MW}	$\approx 2 \times 10^{42}$	kg
mean galaxy *diameter*:	$\frac{\varnothing_{\text{🌀}}}{\varnothing_{MW}}$	$= 0.33$	(my own rough estimate)
galaxy *mass*:	$m_{\text{🌀}}$	$= \left(\frac{\varnothing_{\text{🌀}}}{\varnothing_{MW}}\right)^2 \cdot M_{MW}$	
		$\approx 2.178 \times 10^{41}$	kg.

Total *mass* of all galaxies: $M_{\text{🌀}} = N_{\text{🌀}} \cdot m_{\text{🌀}} = 4.79 \times 10^{52}$ kg. [1]

When I was e^{π} years old,
my own *body length* was: ≈ 1.82 m
so *I* can "estimate": $M_U = 1.82 \cdot M_{\text{🌀}} = 8.72 \times 10^{52}$ kg [2]
as the total *mass* of the universe, recognising that intergalactic matter matters, as a matter of fact.

The *Hubble distance* is related to the entire universe, which is a vast *amount of matter*. And that is the very first item in Newtons Principia: Definitio I: Quantitas Materiæ est mensura etc. It is what he defined as *mass*. And which *lengths* or *distances* are fundamentally related to *mass*? The *Schwarzschild radius* and the *Compton wavelength*. The latter doesn't seem very useful as far as the *Hubble distance* is concerned, does it?

The universe is a glome[1]. Ex obſervatis phænomenis deductum eſt & hypotheſes non finxi. Then its barycentre is nowhere inside it, so it is meaningless to consider it a black hole on itself, but its total *mass* does yield what I will call a *Schwarzschild distance*. This directly links the entire universe to the *speed of light* and so does the *Hubble distance*. Wouldn't it be plausible to equate them?

In a glome, one very specific distance exists, which is its antipodal distance, the greatest possible distance between any pair of objects.

Wouldn't it be in disagreement with the Cosmological Priciple if the universe would have several different distances that are all very specific for the entire universe itself? There would be either an

[1] http://henk-reints.nl/astro/HR-Geometry-of-the-Universe-v2b-20200625T0907Z.pdf

overlap or a hole around the antipodal point. Please realise that any point is also an antipodal point, including our own location, and we do not observe such an overlap or hole in the universe around us, do we?

Therefore both the *Hubble distance* and the *Schwarzschild distance* of the universe must be equal to the *antipodal distance*, hence also to one another. Then we can calculate what I will call the *Hubble-Schwarzschild mass* of the universe.

We have: $r_S = \frac{2GM_{HS}}{c^2} = D_H = \frac{c}{H_0} = 1.30 \times 10^{26}$ metres

hence: $M_{HS} = \frac{c^3}{2GH_0} = 8.77 \times 10^{52}$ kg. [3]

Please compare [2] and [3] and of course they do not exactly match.

As stated on https://en.wikipedia.org/wiki/Schwarzschild_radius#Parameters as of 2020-08-27, the "observable universe" would have[2,3] $r_S \approx 13.77$ Gly (hey, isn't that D_H?) and $M = 8.8 \times 10^{52}$ kg (hey, isn't that the same as [3]?).

Might it be fundamental that $M_U \equiv M_{HS}$? [4]

In my main treatise[4] I estimated: $M_U = 4 \times 10^{53}$ kg, so: $\frac{M_{HS}}{M_U} = 0.21925$ and this factor would apply to many values in this main treatise and several other documents of mine.

For the *IniAll* we find (with $\rho_{n,max} = 1.39 \times 10^{18}$ kg/m^3, see [119] in my main treatise[4]):

Euclidean *radius*: $R_{IniAll} = \sqrt[3]{\frac{3}{4\pi} \cdot \frac{M_{HS}}{\rho_{n,max}}} = 1.65$ au [5]

From now on, I presume it is true that $M_U \equiv M_{HS}$.

Instead of H_0 we should in general use H,

so: $M_U = \frac{c^3}{2GH}$ [6]

Presuming the *mass* of the universe is truly constant over time, GH must be constant as well.

Its value is: $GH = \frac{c^3}{2M_U} = 1.54 \times 10^{-28}$ m^3/kg/s^3 [7]

We already saw that $H = 1/t$, so G must be proportional to t and then the *Schwarzschild radius* $\frac{2GM_{HS}}{c^2}$ would grow together with the *Hubble distance* and G is not a fundamental constant over *time*. Bye bye, Planck units! By the way, Paul Dirac thought G would decrease with the age of the universe[5].

$$m_P = \sqrt{\frac{\hbar c}{G}}, \quad l_P = \sqrt{\frac{\hbar G}{c^3}} = m_P \frac{G}{c^2}, \quad t_P = \sqrt{\frac{\hbar G}{c^5}} = \frac{l_P}{c} = m_P \frac{G}{c^3}, \quad T_P = \sqrt{\frac{\hbar c^5}{G k_B^2}} = m_P \frac{c^2}{k_B}$$

Given that $G \propto t_H$ they would not even be linearly related to the *age* of the universe, unless it would be that $h \propto t_H$ as well... I do not doubt the constancy of the *speed of light*, which to me is just the fundamental ratio of that what we perceive as *distance* and *time*, not simply the *velocity* of photons.

And, just in case you might be interested,

the *Compton wavelength* of $M_U \equiv M_{HS}$ is: $\lambda_{C,U} = \frac{h}{c \cdot M_{HS}} = \frac{2hGH}{c^4} = 2.52 \times 10^{-95}$ m [8]

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[2] Valev, Dimitar (October 2008). "Consequences from conservation of the total density of the universe during the expansion". arXiv:1008.0933 [physics.gen-ph].

[3] Deza, Michel Marie; Deza, Elena (Oct 28, 2012). Encyclopedia of Distances (2nd ed.). Heidelberg: Springer Science & Business Media. p. 452. doi:10.1007/978-3-642-30958-8. ISBN 978-3-642-30958-8.

[4] http://henk-reints.nl/astro/HR-on-the-universe.php

[5] https://www.youtube.com/watch?v=-o8mUyq_Wwg (Dirac himself) & https://www.youtube.com/watch?v=Et8-gg6XNDY

Gravitational constant

Please note that the extension of the universe implies that any $r \propto t$. Kepler's third law: $\omega^2 r^3 = GM$ yields: $\omega^2 r^2 = v^2 = \frac{G}{r}M$, so if both $G \propto t$ and $r \propto t$ then v (rotational *velocity*) would remain constant over *time*.

$G \propto t$ also means the universe would have started with zero *gravity*, thus allowing for the big bang to have actually occurred. To me this makes sense. Have you (n)ever pondered/wondered how the big bang could have overcome the initial gravitation which must have been far too large for anything to escape?

In my main treatise[6] I do calculations on a full disintegration of the *IniAll*, which would be the entire initial universe in the form of neutronium. Free neutrons do indeed decay, but in an atomic nucleus they usually don't, unless there is a surplus of them, in which case the isotope emits beta radiation. If a blob of neutronium were the core of a black hole however, any decay products would never reach the required *escape velocity* being the *speed of light*. And wouldn't the *electric force* that greatly exceeds *gravitation* pull the electrons back? The *IniAll* must certainly have been smaller than its own *Schwarzschild radius* if the current value of G would apply, so it could not have decayed, but it is a fact that it does not exist nowadays. Would *gravity* initially have been zero then that could explain the disintegration of the *IniAll*.

The calculations below assume a 3-spherical geometry of the universe. As derived in my main treatise,

the 3S *volume* of the universe is: $V_U = \frac{2D_H^3}{\pi} = \frac{2c^3 t_H^3}{\pi} = \frac{2c^3}{\pi H_0^3}$ [239] in main treatise [9]

yielding a universal *density* of: $\rho_U = \frac{(M_U = M_{HS})}{V_U} = \frac{c^3}{2GH_0} \cdot \frac{\pi H_0^3}{2c^3} = \frac{\pi H_0^2}{4G}$ [10]

or: $\rho_U = \frac{\pi H_0^3}{2c^3} \cdot M_U \quad = 6.23 \times 10^{-26}$ kg/m³ [11]

and an *atomic density* of: $\frac{N_U}{V_U} = \frac{\rho_U}{u} \quad = 38$ /m³ [12]

We also find: $G = \frac{\pi H^2}{4\rho_U} = \frac{\pi}{4\rho_U t_H^2}$ [13]

and: $G = \frac{\pi H^2}{4 \cdot \frac{\pi H^3}{2c^3} \cdot M_U} = \frac{c^3}{2 \cdot H \cdot M_U} = \frac{c^3 t_H}{2M_U}$ [14]

Might it be fundamental that $\boldsymbol{G = \frac{\pi}{4\rho_U t_H^2} = \frac{c^3 t_H}{2M_U}}$ **?** [15]

Planck constant

Let's plug [15] into the *Planck mass*:

$$m_P = \sqrt{\frac{\hbar c}{G}} = \sqrt{\hbar c \cdot \frac{2M_U}{c^3 t_H}} = \sqrt{\frac{2\hbar M_U}{c^2 t_H}} = \sqrt{\frac{hM_U}{\pi c^2 t_H}} \qquad [16]$$

To me this looks strange. How can the *Planck mass* be proportional to the square root of the *mass* of the universe? Could it be that $h \propto M_U t_H$? After all, [16] yields: $\hbar = G\frac{m_P^2}{c}$.

Let's define: $\xi^2 \coloneqq \frac{\pi c^2 M_U t_H}{h} \therefore h = \frac{\pi c^2 M_U t_H}{\xi^2}$ yielding: $M_U = \xi m_P$ [17]

which looks far better.

Of course, using [6]: $\xi = \frac{M_U}{m_P} = \sqrt{\frac{\pi c^2 M_U t_H}{h}} = \sqrt{\frac{\pi c^5}{2hGH^2}} \approx 4.03 \times 10^{60}$ (dimensionless) [18]

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[6] http://henk-reints.nl/astro/HR-on-the-universe.php

It simply is the amount of matter in the entire universe in terms of the *Planck mass*. But it is proportional to $\sqrt{\frac{t_H}{h}}$. If we ***presume*** it constant, h would be proportional to the age of the universe. We can then simply redefine the *Planck mass* as $m_P = M_U/\xi$. One may doubt how fundamental this unit of mass really is. The other Planck units (especially *Planck length* and *Planck time*) would no longer be fundamental constants, since they are proportional to $m_P G$, hence to the age of the universe.

IF we would consider m_P and M_U and thus ξ more fundamental than h it would mean:

$$[17] \Rightarrow \; h = \frac{\pi c^2 M_U t_H}{\xi^2} = \frac{\pi c^2 M_U t_H}{M_U^2/m_P^2} = \frac{\pi m_P^2 c^2}{M_U} t_H = \pi \cdot \frac{m_P}{M_U} \cdot m_P c^2 \cdot t_H = \pi \cdot \frac{m_P}{M_U} \cdot E_P \cdot t_H \qquad [19]$$

Of course we also recognise the *Planck momentum* $p_P = m_P c$

so: $$h = \frac{\pi m_P^2 c^2}{M_U} t_H = \frac{\pi p_P^2 t_H}{M_U} \qquad \text{and:} \qquad \hbar = \frac{m_P^2 c^2}{2M_U} t_H = \frac{p_P^2 t_H}{2M_U} \qquad [20]$$

also: $$\hbar = \frac{p_P \cdot m_P c \cdot t_H}{2M_U} = \frac{m_P}{M_U} \cdot \frac{p_P \cdot c t_H}{2} = \frac{m_P}{M_U} \cdot \frac{p_P D_H}{2} = \frac{m_P}{M_U} \cdot L_{PH} \qquad [21]$$

where $L_{PH} = p_P \frac{D_H}{2}$ is what I will call the "*Planck-Hubble angular momentum*", which grows with the (unaccelerated[7]) expansion of the universe. It currently equals $L_{PH0} \approx 4.25 \times 10^{26}$ kg m^2/s. It would be the *angular momentum* of a *Planck mass* that is travelling at the *speed of light* along the equator of the largest possible ball around any point in our 3-spherical universe. Such a ball would itself be a 2-equator of the glome. For comparison: the *angular momentum* of the Milky Way Galaxy as if it were a homogeneous disk is in the order of $\frac{2\pi}{250\text{ Ma}} \cdot \left\{\frac{1}{4} \cdot \left(2 \times 10^{42}\text{ kg}\right) \cdot \left(50\text{ kly}\right)^2\right\} \approx 10^{68}$ kg m^2/s, which is way more than L_{PH0} .

The *reduced Planck constant* can now be seen as the *Planck-Hubble angular momentum* averaged over all *mass* in the universe in terms of the *Planck mass*.

Rotating universe

Next is a rather naive approach, but it may give some insight. If the universe were a homogeneous rotating sphere with a *radius* of $R_{U0} = D_{H0}/2$ and an *angular momentum* of L_{PH0} its *angular velocity* would be:

$$\omega_U = \frac{L_{PH0}}{I_U} = \frac{L_{PH0}}{\frac{2}{5} M_U R_{U0}^2} = \frac{L_{PH0}}{\frac{2}{5} M_U \left(\frac{D_{H0}}{2}\right)^2} = \frac{10 L_{PH0}}{M_U D_{H0}^2} = \frac{10 p_P \frac{D_{H0}}{2}}{M_U D_{H0}^2} = \frac{5 p_P}{M_U D_{H0}} = \frac{5 p_P}{M_U c t_{H0}} = \frac{5 m_P c}{M_U c t_{H0}} = \frac{5 m_P H_0}{M_U} \qquad [22]$$

$$\approx 2.86 \times 10^{-78} \text{ rad/s} \quad \text{or} \quad \approx 4.54 \times 10^{-79} \text{ revol./s.}$$

I have no idea in how far this might reflect any reality, but it makes me feel proud to have ~~calculated~~ reasonably estimated the rotation of the entire universe from "fundamental" "constants" of nature!

With a radius of 1.65 au as given by [5], the *IniAll* would then have rotated at

$$\omega_{IniAll} = \frac{L_{PH,IniAll}}{I_{IniAll}} = \frac{m_P c \cdot \frac{D_{H,IniAll}}{2}}{\frac{2}{5} M_U R_{IniAll}^2} = \frac{5 m_P}{4 M_U} \cdot \frac{c^2 t_{H,IniAll}}{R_{IniAll}^2} \qquad [23]$$

assuming: $$t_{H,IniAll} = \frac{R_{IniAll}}{D_{H0}} \cdot \frac{1}{H_0} = \frac{R_{IniAll}}{c} \approx 13{:}43 \text{ (mm:ss)}$$

we obtain: $$\omega_{IniAll} = \frac{5 m_P}{4 M_U} \cdot \frac{c^2 t_{H,IniAll}}{R_{IniAll}^2} = \frac{5 m_P}{4 M_U} \cdot \frac{c^2}{R_{IniAll}^2} \cdot \frac{R_{IniAll}}{c} = \frac{5 m_P}{4 M_U} \cdot \frac{c}{R_{IniAll}} \qquad [24]$$

$$\approx 3.77 \times 10^{-64} \text{ rad/s} \quad \text{or} \quad \approx 6.00 \times 10^{-65} \text{ revol./s}$$

[7] http://henk-reints.nl/astro/HR-Geometry-of-the-Universe-v2b-20200625T0907Z.pdf (via http://henk-reints.nl/UQ)

which also is very slow, but 132×10^{12} times faster than what's given by [22]. This resembles the "pirouette effect" (which it isn't as the *angular momentum* L_{PH} is growing linearly[7] with the expansion of the universe).

When we plug [5] into [24] we obtain:

$$\omega_{IniAll} = \frac{5m_P}{4M_U} \cdot \frac{c}{\sqrt[3]{\frac{3}{4\pi} \cdot \frac{M_U}{\rho_{n,max}}}} = \frac{5m_P}{4M_U} \cdot c \cdot \sqrt[3]{\frac{4\pi\rho_{n,max}}{3M_U}} = p_P \cdot \sqrt[3]{\frac{125\pi\rho_{n,max}}{48M_U^4}} \quad [25]$$

which obviously depends only on the *mass* of the universe, the *Planck momentum*, and the maximum *density* of the neutronium of which I presume the *IniAll* consisted.

Now consider a stationary amount of gas. As it is stationary, its total *momentum* vector equals $\vec{0}$ whilst all molecules are definitely moving, so by absolute value there is a sort of "*internal momentum*" with no specific orientation. Might L_{PH} be something like that? An *internal angular momentum* by absolute value? For a rotating homogeneous sphere in general

we have: $$\omega = \frac{L}{I} = \frac{L}{\frac{2}{5}mr^2} \quad [26]$$

which with [21] yields: $$\frac{5\hbar}{2m_P} = \omega r^2 = vr \quad [27]$$

with $\hbar = \frac{m_P^2 G}{c}$ this becomes: $$\frac{5m_P G}{2c} = vr \quad [28]$$

and with $l_P = m_P \frac{G}{c^2}$ we get: $$\frac{5l_P c}{2} = vr \quad \text{or:} \quad v = \frac{5}{2} \cdot \frac{l_P}{r} \cdot c \quad [29]$$

so a rotating spherical *Planck mass* should have a *diameter* of at least $5l_P$ and then its equator would spin at the *speed of light*. In the form of neutronium a *Planck mass* would contain 1.30×10^{19} neutrons and with $\rho_{n,max} = 1.39 \times 10^{18}$ kg/m³ (the neutronium *density* if neutrons would be compressed to their *Compton wavelength*) it would have a *volume* of ~ 15.66 nm³, hence a *radius* of 1.55 nm.

This would yield a rotation at: $$\omega = \frac{5\hbar}{2m_P r^2} \approx 5.03 \times 10^{-9} \text{ rad/s} \quad \text{or} \quad 8.01 \times 10^{-10} \text{ revol./s} \quad [30]$$

and an equatorial *velocity* of: 7.81 am/s (atto $= 10^{-18}$). [31]

Applying [21] to a single neutron would render the neutron's "*cosmic angular momentum*"

as: $$L_n = \frac{m_n}{M_U} \cdot L_{PH} \approx 1.91 \times 10^{-80} \cdot 4.25 \times 10^{26} \approx 8.12 \times 10^{-54} \text{ kg m}^2\text{/s} \quad [32]$$

also: $$I_n = \frac{2}{5} m_n r_n^2 = \frac{2}{5} \cdot 1.675 \times 10^{-27} \text{ kg} \cdot (0.8 \times 10^{-15})^2 \text{ m}^2 \approx 4.29 \times 10^{-58} \text{ kg m}^2 \quad [33]$$

hence: $$\omega_n = \frac{L_n}{I_n} \approx 19000 \text{ rad/s} \quad \text{or} \quad \sim 3000 \text{ revol./s} \quad [34]$$

yielding an equatorial *velocity* of: $\omega_n r_n \approx 15.2$ pm/s (pico $= 10^{-12}$). [35]

According to quantum mechanics the neutron's *spin angular momentum* is equal to $½\hbar = 5.27 \times 10^{-35}$ kg m²/s which is 6.49×10^{18} times the *cosmic angular momentum* given by [32]. For the $\sim 5.25 \times 10^{79}$ nucleons in the universe this adds up to an *internal angular momentum* of the entire universe equal to $\sim 2.75 \times 10^{45}$ kg m²/s. For a single neutron it yields an *angular velocity* of $\sim 1.23 \times 10^{15}$ rad/s and an *equatorial velocity* of ~ 0.984 m/s. Because of the discrepancy with [34] we should abandon the idea of an *internal angular momentum*.

But, given the fact that the universe absolutely definitely **IS** a glome[8], the *gravitational constant* cannot be constant at all, it must be proportional to the *age* of the universe, and it seems very plausible that

[8] http://henk-reints.nl/astro/HR-Geometry-of-the-Universe-v2b-20200625T0907Z.pdf

the *Planck constant* is proportional to this *age* as well, which would mean all current theories about the evolution of the universe since the very beginning are in Einstein's native language: **voll daneben!**[9]

***Gravitational constant* -- continued**

[15] is the 3-spherical version of Mach's principle. To be more specific, it is the 3-spherical equivalent of Mach8 as given in https://arxiv.org/pdf/gr-qc/9607009.pdf:

> • Mach8: $\Omega = 4\pi\rho G T^2$ *is a definite number of order unity (p475).* (Here, ρ is the mean density matter in the universe and T is the Hubble time. Makes sense in EC only.) Ω does seem to be of order unity in our present universe, but note that of all EC models, only the Einstein–DeSitter makes this number a constant, if Ω is not *exactly* one. Making a theory in which this approximate equality appears natural is a worthwhile and ongoing effort (eg inflationary cosmologies).

The formula given there yields: $G = \Omega/4\pi\rho_U t_H^2$ (cf. [15]: $G = \pi/4\rho_U t_H^2$ which is for 3S geometry)
(And please forget about inflationary cosmologies, see http://henk-reints.nl/astro/Thou-shalt-not-excogitate.pdf.)

I dare to presume both [4] and [15] are true,

therefore: $$\boldsymbol{G = \frac{c^3 t_H}{2M_U}} \qquad [36]$$

or: $$\boldsymbol{GH = \frac{c^3}{2M_U}} \quad \approx 1.536 \times 10^{-28} \quad \text{(m/s)}^3\text{/kg} \qquad [37]$$

Also: $$D_H = \frac{c}{H} \quad \therefore H = \frac{c}{D_H} \quad \therefore GH = G\frac{c}{D_H} = \frac{c^3}{2M_U} \qquad \therefore \boldsymbol{G = \frac{1}{2} D_H \cdot \frac{c^2}{M_U}} \qquad [38]$$

To me, it seems G has to do with the equivalent of *surface tension*, which has a dimension of *force* per *length* or *energy* per *surface area*. Scaling up by one dimension would then yield *energy* per *3-volume* which can thus be seen as the *hyper surface tension* of the glome. As derived further below (to obtain [51]) the dimension of G is:

$$[G] = [energy\ density] \cdot \left[\frac{surface\ area}{mass}\right]^2 = [hyper\ surface\ tension] \cdot \left[\frac{surface\ area}{mass}\right]^2 \qquad [39]$$

This *surface area* would be the glome's 2-dimensional equator, see further below.

Now let us see what comes out if we consider G as something divided by the volume of the universe.

We start with the trivial: $$G = \frac{GV_U}{V_U} \qquad [40]$$

combining [9] and [36] yields: $$GV_U = \frac{c^3 t_H}{2M_U} \cdot \frac{2c^3}{\pi H_0^3} = \frac{c^6 t_H^4}{\pi M_U} = \frac{c^6}{\pi M_U H^4} \qquad [41]$$

hence: $$G = \frac{c^6 t_H^4}{\pi M_U} / V_U \qquad [42]$$

Calculation yields: $$\frac{c^6 t_H^4}{\pi M_U} = 9.4 \times 10^{67}\ \text{m}^6\text{/s}^2\text{/kg} \quad \text{or} \quad \text{m}^4\cdot\text{(m/s)}^2\text{/kg} \qquad [43]$$

This has the dimension of a *hyper volume* times a *velocity*^{2} per *mass*, so let's divide it by the *hyper volume* of the glome and see what comes out.

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[9] https://translate.google.nl/?sl=de&tl=en&text=voll%20daneben&op=translate

The glome's *hyper radius* must be: $R = \frac{D_H}{\pi} = \frac{ct_H}{\pi}$

and its *hyper volume* is given by: $V_4 = \frac{1}{2}\pi^2 R^4 = \frac{1}{2}\pi^2 \cdot \frac{c^4 t_H^4}{\pi^4} = \frac{c^4 t_H^4}{2\pi^2}$

Then: $\frac{GV_U}{V_4} = \frac{c^6 t_H^4/\pi M_U}{c^4 t_H^4/2\pi^2} = \frac{2\pi c^2}{M_U}$

hence: $GV_U = \frac{2\pi c^2}{M_U} \cdot V_4$

or: $G = \frac{2\pi c^2}{M_U} \cdot \frac{V_4}{V_U}$

We find (using [9]): $\frac{V_4}{V_U} = \frac{c^4 t_H^4/2\pi^2}{2c^3 t_H^3/\pi} = \frac{ct_H}{4\pi}$

and then: $\boldsymbol{G = \frac{2\pi c^2}{M_U} \cdot \frac{V_4}{V_U} = \frac{2\pi c^2}{M_U} \cdot \frac{ct_H}{4\pi}}$ [44]

Since it would diminish insight I do not cancel out the 2π and 4π, which of course would bring us back to [36]. In [44], V_4 is the *hyper volume* of the glome and V_U is the *3d-volume* of the universe in 3-spherical geometry, which is the *hyper surface* of the glome.

> Now consider Earth as if it were a perfect sphere. A (mathematical) pole cap's perimeter is a circle of latitude on earth. As observed from the pole along Earth's surface it simply is a circle around it with a *circumference* less then what would be expected if its *radius* is measured along Earth's curved surface. These circles of latitude become greater as they approach the equator, but beyond it they decline all the way to nought in the antipodal point (the opposite pole). The equater itself is the greatest possible circle of latitude. Now Earth's *circumference* equals the equator's *circumference*.
> For a glome (3-sphere) it is similar. A ball around a point on the glome is a 3-sphere cap. Its surface is the equivalent of a circle of latitude on Earth. A ball of latitude so to say, and the greatest possible ball of latitude is the glome's equator. This equator is not a circle but a two-dimensional surface, yielding the glome's two-dimensional *circumference*, which evidently is this equator's *surface area*.

Recapitulation of the equations found for G:

$G = \frac{c^3 t_H}{2M_U} \quad \therefore GH = \frac{c^3}{2M_U}$

$G = \frac{1}{2} D_H \cdot \frac{c^2}{M_U}$ ($\frac{1}{2} D_H$ is the apparent *radius* of the universe's equator, the greatest possible ball around us)

$G = \frac{2\pi c^2}{M_U} \cdot \frac{V_4}{V_U} = \frac{2\pi c^2}{M_U} \cdot \frac{ct_H}{4\pi}$ (related to some sort of *hyper surface tension*)

This should be interpreted as follows.

IF	the universe is a glome
	(which it MUST be based on the SDF and SDSS:DR14Q catalogs)
AND IF	it is closed at its *Schwarzschild radius*
THEN	the *Hubble distance* equals the *Schwarzschild radius* equals the *antipodal distance*
	AND the *gravitational constant* is proportional to the *age* of the universe
HENCE	the universe started with zero *gravitation*
THUS	allowing for the big bang to have occurred at all.

To me this makes sense. It is elegant. It is consistent. It does not contradict anything to my knowledge that has been derived from observed phenomena without fantasising.

Should the entire universe be considered a black hole? I doubt, since the centre of *mass* of the 3-spherical universe does not reside within this same universe, but at the centre of the hypersphere of which the glome just is the 3-surface, cf. the barycentre of Earth's surface not being on this surface but at the centre of the earth.

Now - given that the universe is a glome - we'll consider our own location a pole. Then any ball around us actually is a ball of latitude,

which has a *surface area* of: $A_{3S} = D_H^2 \cdot \frac{4}{\pi} \sin^2 \pi\rho$ [238] in main treatise[10]

its maximum is: $C_U \equiv A_{3S} = D_H^2 \cdot \frac{4}{\pi}$

which would be the universe's two-dimensional *circumference*. Please remember this is a *2d-surface area*. It is the area of a 2-sphere (a "normal" ball) that would fit around the entire 3-sphere (a glome). Let's call it the *outer surface area* of the entire universe itself.

We substitute: $D_H = ct_H$

yielding: $C_U = \frac{4}{\pi} c^2 t_H^2$ [45]

This equals: $C_U = \frac{4}{\pi} c^3 t_H \cdot \frac{t_H}{c}$

In [36] we found: $G = \frac{c^3 t_H}{2M_U} \quad \therefore \; c^3 t_H = 2GM_U$

so: $C_U = \frac{8}{\pi} GM_U \cdot \frac{t_H}{c}$

hence: $G = \frac{\pi c}{8t_H} \cdot \frac{C_U}{M_U} = \frac{\pi cH}{8} \cdot \frac{C_U}{M_U}$ [46]

Please note: this is not constant over time and neither is C_U.

Calculation yields: $\frac{\pi c}{8t_{H0}} = \frac{\pi c H_0}{8} \approx 2.71 \times 10^{-10}$ m/s² or N/kg [47]

It should be obvious that $\frac{C_U}{M_U}$ equals the *surface area* surrounding the universe divided by its *mass*, i.e. the *outer surface area* per *mass*. Then G can be seen as a *force* per *mass* times a *surface area* per *mass*.

This *force* per *mass* is: $\frac{\pi c}{8t_H} = \frac{\pi cH}{8}$ [48]

and the *surface area* per *mass* is: $\frac{C_U}{M_U} = \frac{4c^2 t_H^2}{\pi M_U}$ [49]

The dimension of G can be found as follows.

Newton: $F = m \cdot a = G \cdot \frac{mM}{r^2}$

hence the "*graveleration*": $g \equiv a = \frac{F}{m} = G \cdot \frac{M}{r^2}$

and the *gravitational constant*: $G = g \cdot \frac{r^2}{M}$

Dimension of $g \equiv a$: $[g] \equiv [a] = \left[\frac{force}{mass}\right]$

hence: $[G] = \left[\frac{force}{mass}\right] \cdot \left[\frac{surface\ area}{mass}\right]$ [50]

It also equals:

$$[G] = \left[\frac{force \cdot length}{mass \cdot length}\right] \cdot \left[\frac{surface\ area}{mass}\right]$$
$$= \left[\frac{force \cdot length}{surface\ area \cdot length}\right] \cdot \left[\frac{surface\ area}{mass}\right]^2$$
$$= \left[\frac{energy}{volume}\right] \cdot \left[\frac{surface\ area}{mass}\right]^2$$

[10] http://henk-reints.nl/astro/HR-on-the-universe.php

$$= [energy\ density] \cdot \left[\frac{surface\ area}{mass}\right]^2 \qquad [51]$$

This *energy density* (which effectively is a *pressure*) can be found as follows:

$$[46] \Rightarrow \qquad G = \frac{\pi cH}{8} \cdot \frac{C_U}{M_U} = \frac{\pi cHM_U}{8C_U} \cdot \left(\frac{C_U}{M_U}\right)^2 \qquad [52]$$

hence, using [45]:

$$P := \frac{\pi cHM_U}{8C_U} = \frac{\pi cHM_U}{8 \cdot \frac{4}{\pi} c^2 t_H^2} = \frac{\pi^2 M_U}{32ct_H^3} = \frac{\pi^2 c^2}{32} \cdot \frac{M_U}{D_H^3} = \frac{\pi^2 M_U H^3}{32c} \approx 1.1 \times 10^{-9}\ \text{J/m}^3 \qquad [52]$$

yielding:

$$G = P \cdot \left(\frac{C_U}{M_U}\right)^2 \qquad [53]$$

where P is some *energy density* or *hyper surface tension* of the 3-spherical universe which decreases by t_H^3 as the universe is expanding (cf. blowing up a balloon which is hard in the beginning but becomes easier and easier as the balloon is inflating – difference is that the balloon will end with a big bang whilst the universe started with one ☺), C_U is the *circumference* of the universe, i.e. the *surface area* of its 2-dimensional equator (which increases by t_H^2), and M_U its *mass* which I presume constant over *time*.

The net effect is $G \propto t_H$ and we also found: $h \propto t_H$.
Two presumed universal constants appear to be proportional to the *age* of the universe.

Addendum 2022-03-30/31:

Eq.[9] (3S volume of universe): $V_U = \frac{2D_H^3}{\pi}$

cosmic expansion: $D_H = ct_H \therefore V_U = \frac{2c^3 t_H^3}{\pi}$

volumetric growth: $\frac{dV_U}{dt_H} = \frac{6c^3 t_H^2}{\pi}$

volumetric acceleration: $\frac{d^2V_U}{dt_H^2} = \frac{12c^3 t_H}{\pi} = \frac{24}{\pi} \cdot \frac{c^3 t_H}{2} =$ growing liniarly

eq.[15] (gravitational constant): $G = \frac{c^3 t_H}{2M_U}$

yielding: $GM_U = \frac{\pi}{24} \cdot \frac{d^2V_U}{dt_H^2} = \frac{\pi}{24} \ddot{V}_U$

dimension of GM_U : L^3/T^2

$\boldsymbol{GM_U}$ is purely geometric/kinematic (*which I do not consider a new insight*)
and it **reflects the volumetric acceleration of the cosmic expansion.**


https://apod.nasa.gov/apod/image/0306/carina_hst.jpg

The universe's reaction to Homo Sapiens' excogitations...