Determining the size, mass, gravity and density of the present and primordial universe by means of a modified Einstein's gravitational field equation

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Abstract

In the theory of general relativity, it is possible to calculate the size and age of the cosmos using a new Einsteinian gravitational field equation. The equation describing the radius of the universe contains the mass of the Earth, of which the mass under certain conditions is equivalent to the mass of the cosmos. Looking back in time at the point when the universe was the same size as the Earth as a black hole, the mass of the Earth would increase in parallel with the universe's decreasing size, in the end resulting in the total mass of the cosmos ($5.4976\cdot10^{53}$kg). Under these conditions, the average main mass density of the present cosmos would be $5.9814\cdot10^{-26}$kg·m^{-3}. Using the masses calculated on the basis of the equatorial and polar radius of the Earth, it is possible to determine the 'inside mass of the horizon of the cosmos' in a figure of $2.9075\cdot10^{51}$kg, when the mass density of the universe is $3.1634\cdot10^{-28}$kg·m^{-3}. Solving the newfound equation for g, given that the size of the universe equals to that of the Earth as black hole, it is also possible to determine the total gravity of the primordial universe, which is $9.0273\cdot10^{29}$m·s^{-2}. Replacing these results with the original equation, it is possible to determine both the initial radius and mass of the cosmos in figures of $1.5334\cdot10^{-32}$m and $6.4877\cdot10^{-5}$ kg (both ≈948.8 times the Planck length and Planck mass), while the primordial density is $4.29\cdot10^{90}$ kg·m^{-3}. Under the premise of the above information, the time when the universe may have been formed can be calculated ($5.1151\cdot10^{-41}$s).

Key words: cosmological parameters, high redshift galaxies, general relativity, Earth, gravity, Euclidean geometry, Planck units

Determination of the radius of the universe

Knowing that there is also time shift behind redshift, it is possible to calculate the exact point in time due to the rapid expansion of space in a manner to estimate the time interval involved by invoking the basic laws of physics. Alterations in either the acceleration or the gravitational field result in changes regarding the frequency of light. This shift of the spectrum line to a smaller frequency [1] is demonstrated by the following formula:

$$\nu = \nu_0\left(1+\frac{\Phi}{c^2}\right)\ , \quad (1)$$

where ν is the altered frequency, ν_o is the initial frequency, c is the speed of light and Φ is the gravitation potential difference.

The gravitational potential difference (Φ) is equal to the product of free fall acceleration (g) and the distance (h) between two points of different gravitational potentials: Φ=g·h [1]. Therefore:

$$\nu = \nu_0\left(1+\frac{g\cdot h}{c^2}\right)\ . \quad (1.a)$$

If the same extent of a light beam's redshift measured at farther galaxies [2] is equated to the acceleration of the Earth (as a component of our galaxy), the above formula may also be applied. In this manner, a distance (h) can be calculated pointing towards the origin of the universe. This 'short evolving distance' ($h_{past\ present}$) is:

$$h_{past\ present} = \frac{\nu-\nu_0}{\nu_0}\cdot\frac{c^2}{g_{Earth\ stand}}, \quad (2)$$

where $h_{past\ present}$ is the unknown distance between two points of a gravitational field, $(\nu-\nu_o)/\nu_o$= 3.141592653 is the redshift of the Earth as a component of the highly redshifted Milky Way Galaxy, c is the speed of light ($2.99792458\cdot10^{8}\ m\cdot s^{-1}$) and g is the standard gravity of the Earth ($9.80665\ m\cdot s^{-2}$).

Numerically:

$$h_{past\ present} = 3.141592653\cdot\frac{8.987551787\cdot10^{16}m^{2}\cdot s^{-2}}{9.80665m\cdot s^{-2}} = 2.879191841\cdot10^{16}\,m. \quad (2.a)$$

This distance depends both on the spectrum line shift ratio, which matches to the motion of the Earth, and on the gravity of Earth (Fig.1.a). The 'short evolving distance' ($h_{past\ present}$) can be given by the ratio of the entire plane angle (2π) and the deviation angle (α) of a light beam passing near the Earth's surface caused by the gravitational field: h/α=H/2π. With the ratio calculated from the known 'short evolving distance' (h) and the known two angles (α, 2π), an enormous unknown distance can be calculated which might be termed 'long evolving distance' ($H_{past\ present} = H_{universe}$) (Fig.1.b).

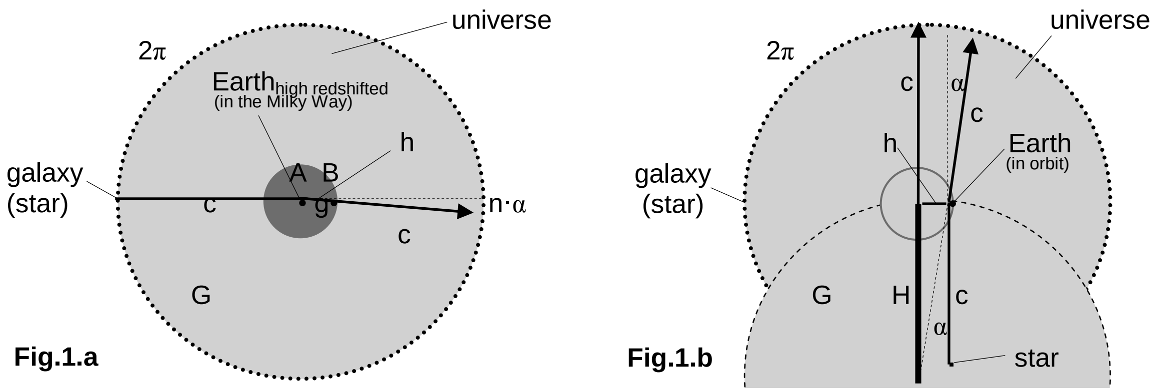

Fig.1 Relationship between the entire plane angle (2π) represented by the expanding universe (with the Earth in the center), and the deviation angle (α) of a light beam (c) passing through the gravitational field of the Earth's surface (g) when the Earth is in motion (n·α) (as a component of our highly redshifted galaxy) along h, from A to B (Fig.1.a), or is comparatively static (α) while in orbit (Fig.1.b).

The deviation angle (α) of a light beam passing near a celestial body's surface, in this case that of the Earth, according to Einstein's formula [1] is:

$$\alpha = \frac{2\cdot G\cdot M}{c^{2}\cdot R}. \quad (3)$$

Therefore:

$$H_{universe\ present} = \frac{\nu-\nu_0}{\nu_0}\cdot\frac{c^{4}}{g_{Earth\ stand}}\cdot\frac{\pi\cdot R_{Earth\ mean}}{G\cdot M_{Earth}}, \quad (4)$$

where $H_{universe}$ is the radius of the universe, $(\nu-\nu_o)/\nu_o$=3.141592653 is the redshift of the Earth (as a component of highly redshifted Milky Way Galaxy), c is the speed of light ($2.99792458\cdot10^{8}\ m\cdot s^{-1}$), π is the ratio of a circle's circumference to its diameter (3.141592653), R is the volumetric mean radius of the Earth ($6.371005\cdot10^{6}$ m), g is the standard gravity of the Earth ($9.80665\ m\cdot s^{-2}$), M is the mass of the Earth ($5.97219\cdot10^{24}$ kg) [3] and G is the gravitational constant ($6.673848\cdot10^{-11}\ m^{3}\cdot kg^{-1}\cdot s^{-2}$) [4].

When considering the large redshift ($(\nu-\nu_o)/\nu_o$= 3.141592) which may be measured from farther stars, the 'long evolving distance' ($H_{past\ present}$) equals $12.994509\cdot10^{25}$ m, the radius of the universe according to our present knowledge [5]:

$$H_{universe\ present} = 3.141592653\cdot\frac{80.77608713\cdot10^{32}m^{4}\cdot s^{-4}\cdot3.141592653\cdot6.371005\cdot10^{6}m}{9.80665m\cdot s^{-2}\cdot6.673848\cdot10^{-11}m^{3}\cdot kg^{-1}\cdot s^{-2}\cdot5.97219\cdot10^{24}kg} = 12.994509779\cdot10^{25}m. \quad (5)$$

(The usage of this redshift value is important regarding both mathematical and physical aspects, which will be described through the following article [6].)

Determination of the mass of the universe

On the basis of the new Einsteinian gravitational field equation found in the theory of general relativity and elaborated to determine the radius of universe [6], it could also be used to calculate the mass of the cosmos:

$$H_{universe\ present} = \frac{\nu - \nu_0}{\nu_0} \cdot \frac{c^4}{g_{Earth\ stand}} \cdot \frac{\pi \cdot R_{Earth\ mean}}{G \cdot M_{Earth}}. \quad (6)$$

If we solve the equation for M, we get the following:

$$M_{Earth} = \frac{\nu - \nu_0}{\nu_0} \cdot \frac{c^4}{H_{universe\ present} \cdot g_{Earth\ stand}} \cdot \frac{\pi \cdot R_{Earth\ mean}}{G}. \quad (7)$$

If the radius of the universe would be equal to what we know today (eq.4), the mass of the Earth could be calculated. Numerically:

$$M_{Earth} = 3.141592653 \cdot \frac{80.77608713 \cdot 10^{32} m^4 \cdot s^{-4}}{12.994509779 \cdot 10^{25} m \cdot 9.80665 m \cdot s^{-2}} \cdot \frac{3.141592653 \cdot 6.371005 \cdot 10^6 m}{6.673848 \cdot 10^{-11} m^3 \cdot kg^{-1} \cdot s^{-2}} = 5.97219 \cdot 10^{24} kg. \quad (8)$$

If back in time, the present radius of the cosmos (H) was equal to the size of the 'short evolving distance' (h) in the case of Earth's surface g, at the Earth's mean radius and 3.1416 redshift, the mass of the Earth would increase. This mass termed as the 'first intermediate mass of the cosmos' ($M_{universe\ intermed.1}$) could be:

$$M_{universe\ intermed.1} = \frac{\nu - \nu_0}{\nu_0} \cdot \frac{c^4}{h \cdot g_{Earth\ stand}} \cdot \frac{\pi \cdot R_{Earth\ mean}}{G}, \quad (9)$$

which is:

$$M_{universe\ intermed.1} = 3.141592653 \cdot \frac{80.77608713 \cdot 10^{32} m^4 \cdot s^{-4}}{2.879191841 \cdot 10^{16} m \cdot 9.80665 m \cdot s^{-2}} \cdot \frac{3.141592653 \cdot 6.371005 \cdot 10^6 m}{6.673848 \cdot 10^{-11} m^3 \cdot kg^{-1} \cdot s^{-2}} = 2.6954 \cdot 10^{34} kg. \quad (10)$$

As the second step going back further in time and reducing the radius of the cosmos from the size of the 'short evolving distance' (h) to the radius of the Earth (h_h), it could have the 'second intermediate mass of the universe'($M_{universe\ intermed.2}$):

$$M_{universe\ intermed.2} = \frac{\nu - \nu_0}{\nu_0} \cdot \frac{c^4}{h_h \cdot g_{Earth\ stand}} \cdot \frac{\pi \cdot R_{Earth\ mean}}{G}, \quad (11)$$

this is:

$$M_{univ.intermed.2} = 3.141592653 \cdot \frac{80.77608713 \cdot 10^{32} m^4 \cdot s^{-4}}{6.371005 \cdot 10^6 m \cdot 9.80665 m \cdot s^{-2}} \cdot \frac{3.141592653 \cdot 6.371005 \cdot 10^6 m}{6.673848 \cdot 10^{-11} m^3 \cdot kg^{-1} \cdot s^{-2}} = 1.2181 \cdot 10^{44} kg\ . \quad (12)$$

As the third step, the reduction of the size of the cosmos from the radius of the Earth (h_h) to the size of the Earth as a black hole (h_{hh}) could result in the total mass of the cosmos.

The radius of the universe reduced by the ratio of a light beam's angle (α) passing near the Earth's surface (bending by g) and of the entire plane angle (2π), the total main mass of the cosmos ($M_{universe\ total\ mean}$) could be determined (Fig.2.a and b):

$$M_{universe total\ mean\ present} = \frac{\nu - \nu_0}{\nu_0} \cdot \frac{c^4}{\frac{\alpha}{2\pi} \cdot h_h \cdot g_{Earth\ stand}} \cdot \frac{\pi \cdot R_{Earth\ mean}}{G}. \quad (13)$$

In this case, the radius of the cosmos is equal to Earth's radius as a black hole:

$$h_{h_{h\ universe}} = \frac{\alpha}{2 \cdot \pi} \cdot h_h = \frac{2 \cdot G \cdot M_{Earth}}{c^2 \cdot R_{Earth\ mean}} \cdot \frac{1}{2 \cdot \pi} \cdot h_h = \frac{6.673848 \cdot 10^{-11} m^3 \cdot kg^{-1} \cdot s^{-2} \cdot 5.97219 \cdot 10^{24} kg}{8.98755178 \cdot 10^{16} m^2 \cdot s^{-2} \cdot 3.141592653} = 1.41162275 \cdot 10^{-3} m. \quad (14)$$

Multiply this value by 2π, we could get the Schwarzschild radius of the Earth ($R_{Schw}=2\cdot G\cdot M\cdot c^{-2}$ = $8.869487322\cdot 10^{-3}$m) [7]. At this size (eq.14) of the cosmos, the total mean mass of the universe is the following:

$$M_{univ.tot.mean\ pres.} = 3.141592653 \cdot \frac{80.77608713\cdot 10^{32} m^4\cdot s^{-4}}{1.41162275\cdot 10^{-3} m\cdot 9.80665 m\cdot s^{-2}}\cdot\frac{3.141592653\cdot 6.371005\cdot 10^{6} m}{6.673848\cdot 10^{-11} m^3\cdot kg^{-1}\cdot s^{-2}} = 5.497621893\cdot 10^{53} kg. \quad (15)$$

In this manner, the threefold reduction of the radius of the universe by tenth order of magnitude ($H > h > h_h > h_{hh(Earth\ as\ black\ hole)}$) could result in the total mass of the cosmos ($M_{Earth} < M_{univ.intermed.1} < M_{univ.intermed.2} < M_{universe\ total\ mean}$), while g is constant and equal to the Earth's g standard (9.80665 $m\cdot s^{-2}$).

On the contrary, while the size of the cosmos has been increasing constantly from the past to the present, the mass of universe has decreased significantly. Growing from the radius of the cosmos equal to that of Earth as black hole to the size of today ($h_{hh(Earth\ as\ black\ hole)} < h_h < h < H$), the mass of the universe would decrease extremely ($M_{universe} > M_{intermed.2} > M_{intermed.1} > M_{Earth}$). In the end, the Earth's mass could be calculated throughout the mass of intermediates ($M_{univ.intermed.2} > M_{univ.intermed.1}$).

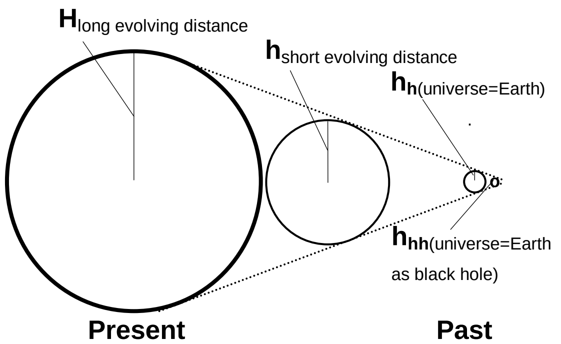

Fig.2.a g=constant (9.8 $m\cdot s^{-2}$)

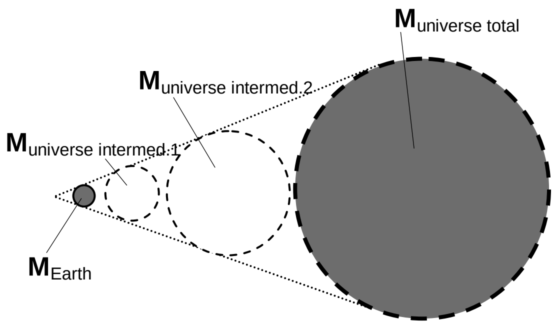

Fig.2.b g=constant (9.8 $m\cdot s^{-2}$)

The effect of the elliptical shape of the Earth in correlation with its g on the mass of the cosmos

In case the Earth would not be round with mean g as it is described above, but would have an elliptical shape and the surface g would vary from the equator to the poles, the mass of the cosmos would be different too (Fig.3.a). Between the range of the Earth's g, a maximum and a minimum value of the universe's mass could be determined (Fig.3.b.) [8]. In the case of the equatorial g of the Earth, the mass of the cosmos would have a greater value:

$$M_{universe\,total\,equat.min.} = \frac{\nu-\nu_0}{\nu_0}\cdot\frac{c^4}{h_{h_h}\cdot g_{Earth\,equat(0^o)}}\cdot\frac{\pi\cdot R_{Earth\,mean}}{G}, \quad (16)$$

where g at latitude 0^o is 9.78033 $m\cdot s^{-2}$ [9], then:

$$M_{univ.tot.equat.min.} = 3.141592653 \cdot \frac{80.77608713\cdot 10^{32} m^4\cdot s^{-4}}{1.41162275\cdot 10^{-3} m\cdot 9.78033 m\cdot s^{-2}}\cdot\frac{3.141592653\cdot 6.371005\cdot 10^{6} m}{6.673848\cdot 10^{-11} m^3\cdot kg^{-1}\cdot s^{-2}} = 5.512416630\cdot 10^{53} kg. \quad (17)$$

Using the polar gravity of the Earth for the calculations, the total mass of the universe would be smaller:

$$M_{universe\,total\ polar\ min.} = \frac{\nu-\nu_0}{\nu_0}\cdot\frac{c^4}{h_{h_h}\cdot g_{Earth\ polar(90^o N)}}\cdot\frac{\pi\cdot R_{Earth\ mean}}{G}, \quad (18)$$

where g at latitude 90^oN is 9.83219 $m\cdot s^{-2}$, numerically:

$$M_{univ.tot.polar\,min.} = 3.141592653 \cdot \frac{80.77608713\cdot 10^{32} m^4\cdot s^{-4}}{1.41162275\cdot 10^{-3} m\cdot 9.83219 m\cdot s^{-2}}\cdot\frac{3.141592653\cdot 6.371005\cdot 10^{6} m}{6.673848\cdot 10^{-11} m^3\cdot kg^{-1}\cdot s^{-2}} = 5.483341325\cdot 10^{53} kg. \quad (19)$$

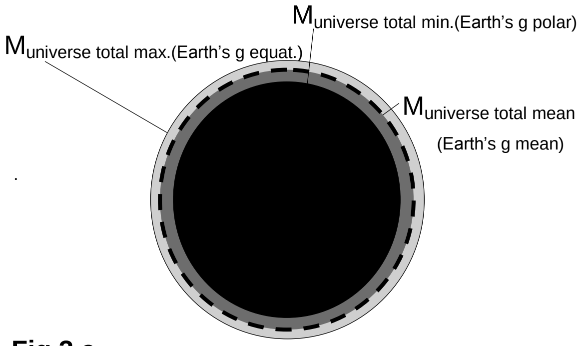

Fig.3.a

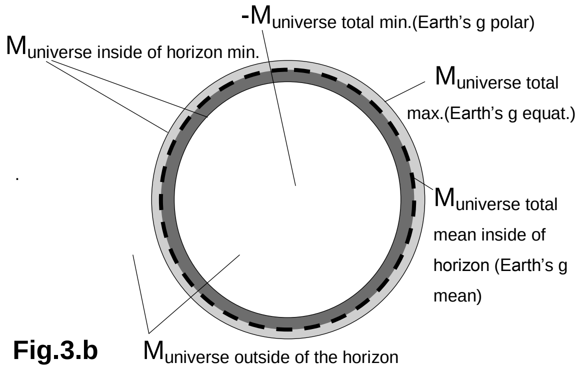

Fig.3.b

Between the two endpoints of the Earth's surface gravity, the universe seems to be flat and observable. The total mass of this range is the following:

$$M_{universe\,total\,inside\,of\,horizon\,\min.} = M_{universe\,total\,equat.\min} - M_{universe\,total\,polar\,\min.} \quad (20)$$

Numerically:

$$M_{univ.tot.inside\,of\,horizon\,\min.} = 5.512416630 \cdot 10^{53}\,kg - 5.483341325 \cdot 10^{53} kg = 0.029075305 \cdot 10^{53} kg = 2.9075305 \cdot 10^{51} kg. \quad (21)$$

/Using the radius of the Earth instead of its main radius at a given latitude, the total mass of the inside of the horizon would change by a small amount and provide its maximal value ($M_{universe\ inside\ of\ horizon\ max.}$)./

This value (eq.20) contains the whole area of the Earth's surface from the equator to the poles ($0^o \rightarrow 90^o$N and $0^o \rightarrow 90^o$S), which could be divided into four zones each.

Calculating with the first zone of the surface of the Earth from latitude $0^o$to 23.5^oN originated from both the elliptical shape and the tilt of the rotational axis of the Earth [10], this part of the total mass of the inside of the horizon of the cosmos is:

$$M_{universe\,total\,equatorial(23.5^o N)} = \frac{\nu - \nu_0}{\nu_0} \cdot \frac{c^4}{h_{h_h} \cdot g_{equatorial(23.5^o N)}} \cdot \frac{\pi \cdot R_{Earth\,mean}}{G}, \quad (22)$$

where g at latitude 23.5^oN is: $9.78854 m \cdot s^{-2}$ [9], this is:

$$M_{univ.tot.equat.(23.5^o N)} = 3.141592653 \cdot \frac{80.77608713 \cdot 10^{32} m^4 \cdot s^{-4}}{1.41162275 \cdot 10^{-3} m \cdot 9.78854 m \cdot s^{-2}} \cdot \frac{3.141592653 \cdot 6.371005 \cdot 10^6 m}{6.673848 \cdot 10^{-11} m^3 \cdot kg^{-1} \cdot s^{-2}} = 5.507793168 \cdot 10^{53} kg, \quad (23)$$

thus:

$$M_{universe\,inside\,of\,horizon\,(0^o - 23.5^o N,\ tilt)} = M_{universe\,total\,equat.(0^o)} - M_{universe\,total\,equat.(23.5^o N)}, \quad (24)$$

numerically:

$$M_{univ.tot.inside\,of\,horizon\,(0^o - 23.5^o N,\ tilt)} = 5.5124184853 \cdot 10^{53} kg - 5.507793168 \cdot 10^{53} kg = 4.625317 \cdot 10^{50} kg. \quad (25)$$

This is 4.625316/29.075305≈15.908% of the total mass of the inside of the cosmos' horizon.

The second zone of the surface of the Earth with reference to the orbital motion of the Earth around the Sun, from latitude 23.5^oN ($g=9.78854\ m \cdot s^{-2}$) to 47^oN ($g=9.80801\ m \cdot s^{-2}$) in the same way (eq.22-25), this section of the total mass of the inside horizon of the universe is:

$$M_{univ.tot.inside\,of\,horizon\,(23.5^o N - 47^o N,\ orbit)} = 5.507793168634 \cdot 10^{53} kg - 5.4968595814 \cdot 10^{53} kg = 10.933587 \cdot 10^{50} kg. \quad (26)$$

This is 10.933587/29.075305≈37.604% of the total mass of the inside of the horizon of the cosmos.

Calculating with the third zone of the surface of the Earth from latitude 47^oN ($g=9.80801\ m \cdot s^{-2}$) to 66.5^oN ($g=9.82391\ m \cdot s^{-2}$) originated also from the orbital motion of the Earth around the Sun, (on the basis of eq. 22-25), this part of the total mass of inside of horizon of cosmos is:

$$M_{univ.tot.inside\,of\,horizon\,(47^o N-66.5^o N,\ orbit)} = 5.4968595814\cdot 10^{53}kg - 5.487962913\cdot 10^{53}kg = 8.896668\cdot 10^{50}kg. \quad (27)$$

This is 8.896668/29.075305≈30.598% of the total mass of the inside of the horizon of the cosmos. The sum of the second and third (orbital) zones is ≈68.2%.

Calculating with the fourth zone of the surface of the Earth from latitude 66.5^{o}N (g=9.80801 m·s^{-2}) to 90^{o}N (g=9.83219 m·s^{-2}) originated from the elliptical shape of the Earth and from the tilt of its rotational axis, this section of the total mass of the inside of the horizon of the cosmos (on the basis of eq. 22-25) is:

$$M_{univ.tot.inside\,of\,horizon\,(66.5^o N-90^o N,\ tilt)} = 5.487962913\cdot 10^{53}kg - 5.483341325\cdot 10^{53}kg = 4.621588\cdot 10^{50}kg. \quad (28)$$

This is 4.621588/29.075305≈15.895% of the total mass of inside of horizon of cosmos. The sum of the first and fourth (tilt) zones is ≈31.8%.

The gravity of the primordial universe

On the basis of the new Einsteinian gravitation field equation (eq.4), the entire gravity of the primordial cosmos could also be calculated. Therefore:

$$H_{universe\,present} = \frac{\nu-\nu_0}{\nu_0}\cdot\frac{c^4}{g_{Earth\,stand}}\cdot\frac{\pi\cdot R_{Earth\,mean}}{G\cdot M_{Earth}}. \quad (29)$$

Based on this equation, the value of Earth's surface gravity ($g_{Earth\ stand.}$) can be calculated. Solving the equation for g, we get the following:

$$g_{Earth\,stand} = \frac{\nu-\nu_0}{\nu_0}\cdot\frac{c^4}{H_{universe\,present}}\cdot\frac{\pi\cdot R_{Earth\,mean}}{G\cdot M_{Earth}}. \quad (30)$$

In this case the space-time bend (by $g_{Earth\ stand.}$) of the present universe' could be determined, when it is approximately flat and Euclidean. Numerically:

$$g_{Earth\,stand} = 3.141592653\cdot\frac{80.77608713\cdot 10^{32}m^4\cdot s^{-4}}{12.994509779\cdot 10^{25}m}\cdot\frac{3.141592653\cdot 6.371005\cdot 10^6 m}{6.673848\cdot 10^{-11}m^3\cdot kg^{-1}\cdot s^{-2}\cdot 5.97219\cdot 10^{24}kg} = 9.80665\ m\cdot s^{-2}. \quad (31)$$

When the radius of the cosmos is determined before reduced from (H) to the size of the 'short evolving distance' (h), the first intermediate gravity ($g_{univ.intermed.1}$) of cosmos could be calculated:

$$g_{universe\,intermed.1} = \frac{\nu-\nu_0}{\nu_0}\cdot\frac{c^4}{h}\cdot\frac{\pi\cdot R_{Earth\,mean}}{G\cdot M_{Earth}}, \quad (32)$$

and:

$$g_{univ.intermed.1} = 3.141592653\cdot\frac{80.77608713\cdot 10^{32}m^4\cdot s^{-4}}{2.879191841\cdot 10^{16}m}\cdot\frac{3.141592653\cdot 6.371005\cdot 10^6 m}{6.673848\cdot 10^{-11}m^3\cdot kg^{-1}\cdot s^{-2}\cdot 5.97219\cdot 10^{24}kg} = 4.425985\cdot 10^{10}m\cdot s^{-2}. \quad (33)$$

As the second step and also going back in time, reducing the radius of the cosmos from the size of the 'short evolving distance (h) to the radius of the Earth (h_h), the 'second intermediate gravity of the universe' ($g_{univ.intermed.2}$) could be calculated:

$$g_{universe\,intermed.2} = \frac{\nu-\nu_0}{\nu_0}\cdot\frac{c^4}{h_h}\cdot\frac{\pi\cdot R_{Earth\,mean}}{G\cdot M_{Earth}}, \quad (34)$$

thus:

$$g_{univ.intermed.2} = 3.141592653\cdot\frac{80.77608713\cdot 10^{32}m^4\cdot s^{-4}}{6.371005\cdot 10^6 m}\cdot\frac{3.141592653\cdot 6.371005\cdot 10^6 m}{6.673848\cdot 10^{-11}m^3\cdot kg^{-1}\cdot s^{-2}\cdot 5.97219\cdot 10^{24}kg} = 2.00019\cdot 10^{20}\ m\cdot s^{-2}. \quad (35)$$

As the third step, by reducing the size of the cosmos from (h_h) to its size when the Earth as a black hole (Fig.2.a), the total mass of the cosmos could be calculated:

$$g_{universe\ primordial} = \frac{\nu - \nu_0}{\nu_0} \cdot \frac{c^4}{\frac{\alpha}{2\pi} \cdot h_h} \cdot \frac{\pi \cdot R_{Earth\ mean}}{G \cdot M_{Earth}}. \quad (36)$$

When the radius of the universe is equal to the Earth and reduced to the size of the Earth as black hole by the ratio of a light beam's angle (α) passing near the Earth surface bending by g and the entire plane angle (2π), the primordial cosmos' whole gravity could be determined ($g_{universe\ primordial}$).

Numerically:

$$h_{h_{univ.primord.}} = \frac{\alpha}{2 \cdot \pi} \cdot h_h = \frac{2 \cdot G \cdot M_{Earth}}{c^2 \cdot R_{Earth,mean}} \cdot \frac{1}{2 \cdot \pi} \cdot h_h = \frac{6.673848 \cdot 10^{-11} m^3 \cdot kg^{-1} \cdot s^{-2} \cdot 5.97219 \cdot 10^{24} kg}{8.98755178 \cdot 10^{16} m^2 \cdot s^{-2} \cdot 6.371005 \cdot 10^6 m \cdot 3.141592653} \cdot 6.371005 \cdot 10^6 m = 1.41162275 \cdot 10^{-3} m. (37)$$

Multiplying this value by 2π, we could get the Schwarzschild radius of the Earth ($R_{Schw} = 2 \cdot G \cdot M \cdot c^{-2} = 8.869487322 \cdot 10^{-3}$m) as a result. At this size of the cosmos, the entire gravity of the universe is the following:

$$g_{univ.primord.} = 3.141592653 \cdot \frac{80.77608713 \cdot 10^{32} m^4 \cdot s^{-4}}{1.41162275 \cdot 10^{-3} m} \cdot \frac{3.141592653 \cdot 6.371005 \cdot 10^6 m}{6.673848 \cdot 10^{-11} m^3 \cdot kg^{-1} \cdot s^{-2} \cdot 5.97219 \cdot 10^{24} kg} = 9.027384216 \cdot 10^{29} m \cdot s^{-2}. \quad (38)$$

In this way by the threefold reduction of the radius of the universe by tenth of order of magnitude ($H_{universe} > h > h_h > h_{hh(Earth\ as\ black\ hole)}$) could result in the entire gravity of the primordial universe ($g_{Earth} < g_{intermed.1} < g_{intermed.2} < g_{primordial\ universe}$), when the mass of the universe equals to that of the Earth (Fig.4.a and b).

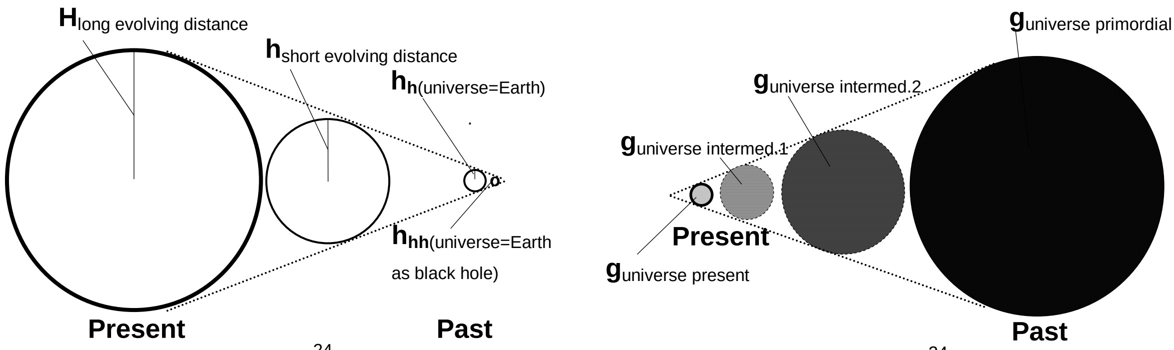

Fig.4.a M=6·10^24 kg **Fig.4.b** M=6·10^24 kg

On the contrary, if the size of the cosmos would have been developing from the past to the present, increasing from the value of the Earth's radius as a black hole up to the radius of the universe nowadays (assuming that the mass of the Earth doesn't change) the entire g of the primordial cosmos would be reduced in the end step by step, reaching the normal value of the Earth's surface g.

The density of the present and primordial universe

The mass density of the universe ($\rho_{universe}$) can be calculated by dividing its mass ($M_{universe}$) by its volume ($V_{universe}$):

$$\rho_{universe\ present\ at\ H\ and\ M_{univ.tot.mean.}} = \frac{M_{universe}}{V_{universe\ at\ H}} = \frac{M_{universe} \cdot 3}{4 \cdot \pi \cdot h^3}. \quad (39)$$

Numerically:

$$\rho_{universe\ present\ at\ H\ and\ M_{univ.tot.mean}} = \frac{5.4976218936 \cdot 10^{53} kg \cdot 3}{4 \cdot \pi \cdot H_{universe}^3} = \frac{16.4928656808 \cdot 10^{53} kg}{12.566370614 \cdot (12.99450 \cdot 10^{25} m)^3} = 5.981464 \cdot 10^{-26} kg \cdot m^{-3}. \quad (40)$$

Using the mass of the cosmos calculated on the basis of the equatorial and polar radius of the Earth, it is possible to determinate the 'inside mean density of the horizon of the universe'. In a figure of $2.9075 \cdot 10^{51}$ kg (eq.20) and at the present radius of the cosmos ($H_{universe}$) the $\rho_{universe\ present\ at\ H}$ can be calculated by the following:

$$\rho_{universe\ present\ at\ H\ and\ M_{univ.tot.inside\ of\ horizon}} = \frac{2.9075305 \cdot 10^{51} kg \cdot 3}{4 \cdot \pi \cdot H_{universe}{}^{3}} = \frac{8.7225915 \cdot 10^{51} kg}{12.566370614 \cdot (12.99450 \cdot 10^{25} m)^3} = 3.163420 \cdot 10^{-28} kg \cdot m^{-3}. \quad (40.a)$$

In this range (between 40 and 40.a), the mass density of today's universe could be determined, in case the cosmos is flat and Euclidean. Exceeding the limit of eq. 40 the universe is too dense, thus it may be collapsed by its gravitational force. If the density of cosmos would be less than the result value of equation 40.a, it would expand constantly because the matter it contains is too small to retain itself together [11].

Comparing the current volume of the cosmos to the size of the short evolving distance (h) if the total mass of the universe would be the same today, the density would increase significantly:

$$\rho_{universe\ at\ h} = \frac{M_{universe}}{V_{universe\ at\ h}} = \frac{16.4928656808 \cdot 10^{53} kg}{12.566370614 \cdot (2.879191841 \cdot 10^{16} m)^3} = 5.49888 \cdot 10^{3} kg \cdot m^{-3}. \quad (41)$$

This value is equal to the Earth's mean density. In the volume ($V_{universe}$) of the radius of the short evolving distance (h), there is the same distribution of mater as in the Earth. In this volume, a homogenous gravitational field similar to the inside of the Earth also exists. It seems like the Earth (with its surface gravity) would recede in two dimensions by the value of redshift of $(\nu-\nu_o)/\nu_o$= 3.141592 from the opposite galaxy by the mean of simple relativity. In three dimensions, the Earth would be moving towards every direction from every opposite galaxy at the same time. In this case, there would be a sphere forming around the Earth (h), transforming the stars' redshift to our planet. So the Earth would fill out this space (h) due to its mass homogenously by the same density as in figure 1.a.

Back in time, the short evolving distance (h) would have decreased to the radius of the Earth (h_h), if the mass of the cosmos would have not changed, the mass density would have been the following:

$$\rho_{universe\ pimordial at\ h_h} = \frac{M_{universe}}{V_{universe\ h_h}} = \frac{M_{universe} \cdot 3}{4 \cdot \pi \cdot h_h{}^{3}} \ . \quad (42)$$

This is numerically:

$$\rho_{univ.primord.at\ h_h} = \frac{16.4928656808 \cdot 10^{53} kg}{12.566370614 \cdot (6.371005 \cdot 10^{6} m)^3} = 5.0753082 \cdot 10^{32} kg \cdot m^{-3}. \quad (43)$$

If the size of cosmos (H) would decrease to this value, given that the Earth is a black hole (h_{hh}) and the total mass of the cosmos ($M_{universe\ total}$) does not change, the density would increase by approximately 30 orders of magnitude:

$$\rho_{universe\ at\ h_{h_h} and\ M_{univ.tot.}} = \frac{M_{universe}}{V_{universe\ h_{h_h}}} = \frac{M_{universe} \cdot 3}{4 \cdot \pi \cdot h_{h_h}{}^{3}} \ . \quad (44)$$

This is numerically:

$$\rho_{universe\ at\ h_{h_h} and\ M_{univ.tot.}} = \frac{16.4928656808 \cdot 10^{53} kg}{12.566370614 \cdot (1.41162275 \cdot 10^{-3} m)^3} = 4.665845 \cdot 10^{61} kg \cdot m^{-3}. \quad (45)$$

If the size of cosmos would be equal to that of the Earth as a black hole (h_{hh}) and the total mass of the universe would be reduced on its way back in time through the intermediate masses to the size of the Earth, the density would be the same as the former one (eq.43):

$$\rho_{universe\ primord.at\ h_{h_h} and\ M_{Earth}} = \frac{M_{universe\ Earth}}{V_{universe\ h_{h_h}}} = \frac{M_{Earth} \cdot 3}{4 \cdot \pi \cdot h_{h_h}{}^{3}} \ . \quad (46)$$

This is:

$$\rho_{universe\ primord.at\ h_{h_h} and\ M_{Earth}} = \frac{17.91657 \cdot 10^{24} kg}{12.566370614 \cdot (1.41162275 \cdot 10^{-3} m)^3} = 5.0686121 \cdot 10^{32} kg \cdot m^{-3}. \quad (47)$$

Using the primordial mass and size of the universe, the density will be larger than this.

The size of the primordial universe determined by the primordial gravity and present mass of the cosmos

Replacing these macro-data calculated before ($g_{universe\ primord.}$ and $M_{universe\ total}$) to the newfound Einsteinian gravitation field equation (4) elaborated for the determination of the radius of the cosmos the size of universe extremely decreases. The original equation (4) is:

$$H_{universe\ present} = \frac{\nu - \nu_0}{\nu_0} \cdot \frac{c^4}{g_{Earth\ stand}} \cdot \frac{\pi \cdot R_{Earth\ mean}}{G \cdot M_{Earth}}. \quad (48)$$

Substituting the value of the primordial gravity of the cosmos ($g_{univ.primord.}$) and its total mass ($M_{univ.tot.mean}$) into the equation the radius of the primordial cosmos is:

$$H_{universe\ primordial} = \frac{\nu - \nu_0}{\nu_0} \cdot \frac{c^4}{g_{universe\ primordial mean}} \cdot \frac{\pi \cdot R_{Earth\ mean}}{G \cdot M_{universe total\ mean}}. \quad (49)$$

Numerically:

$$H_{univ.primord.} = 3.141592653 \cdot \frac{80.77608713 \cdot 10^{32} m^4 \cdot s^{-4} \cdot 3.141592653 \cdot 6.371005 \cdot 10^6 m}{9.0273842 \cdot 10^{29} m \cdot s^{-2} \cdot 6.673848 \cdot 10^{-11} m^3 \cdot kg^{-1} \cdot s^{-2} \cdot 5.497622 \cdot 10^{53} kg} = 1.5334774356 \cdot 10^{-32} m. \quad (50)$$

The theoretically definable smallest length in the universe is the Planck length which is $1.61622938 \cdot 10^{-35}$ m [4]. The ratio of this result and the Planck length is 948.8. For this reason, the total mass of the present cosmos and the entire primordial gravitation of the universe do not exceed these values, neither together, nor separately (eq.14, 29) significantly by more than 3 tenth of order of magnitude, because in this case the size of the primordial cosmos would be smaller than the Planck length. Multiplying this rate by π this is 2980.74 (see eq. 53).

From this distance value presented in eq. 50, it is possible to calculate the initial time when the universe may have been formed. This time ($T_{universe\ initial}$) is proportional to the ratio of the radius of the primordial cosmos ($H_{universe\ primord.}$) and of the speed of light (c):

$$T_{universe initial} = \frac{H_{universe\ primordial}}{c} = \frac{1.5334774356 \cdot 10^{-32} m}{2.99792458 \cdot 10^8 \mathrm{m} \cdot \mathrm{s}^{-1}} = 5.11513 \cdot 10^{-41} s. \quad (50.a)$$

The mass of the primordial cosmos calculated by the primordial gravity and present radius of the universe

According to the original equation (4), the present radius of universe is the following:

$$H_{universe\ present} = \frac{\nu - \nu_0}{\nu_0} \cdot \frac{c^4}{g_{Earth\ stand.}} \cdot \frac{\pi \cdot R_{Earth\ mean}}{G \cdot M_{Earth}} \cdot \quad (51)$$

Based on the above and using of the primordial gravity (eq. 38) and present radius of the cosmos (eq. 5) at the Earth' radius, the mass of the primordial cosmos is:

$$M_{universe\ primordial} = \frac{\nu - \nu_0}{\nu_0} \cdot \frac{c^4}{g_{universe\ primordial}} \cdot \frac{\pi \cdot R_{Earth\ mean}}{G \cdot H_{universe\ present}}. \quad (52)$$

Numerically:

$$M_{univ.primord.} = 3.141592653 \cdot \frac{80.77608713 \cdot 10^{32} m^4 \cdot s^{-4} \cdot 3.141592653 \cdot 6.371005 \cdot 10^6 m}{9.0273842 \cdot 10^{29} m \cdot s^{-2} \cdot 6.673848 \cdot 10^{-11} m^3 \cdot kg^{-1} \cdot s^{-2} \cdot 12.994509779 \cdot 10^{25} m \cdot} = 6.487724 \cdot 10^{-5} kg. \quad (53)$$

As the Planck mass is $2.17647051 \cdot 10^{-8}$ kg [4], this value is 2980.84627 times more than the Planck mass. Divided it by π, it is 948.8328 (see eq. 50).

The gravity of the primordial universe determined by the present radius and primordial mass of the cosmos

With the same logic, it is possible to calculate the gravity of the primordial cosmos, using the present radius of the universe and the mass of the primordial cosmos the initial gravity could have. The original equation (4) describing the radius of the universe is:

$$H_{universe\ present} = \frac{\nu - \nu_0}{\nu_0} \cdot \frac{c^4}{g_{Earth\ stand.}} \cdot \frac{\pi \cdot R_{Earth\ mean}}{G \cdot M_{Earth}}. \quad (54)$$

From this, the initial gravity of the cosmos is:

$$g_{universe\ primordial} = \frac{\nu - \nu_0}{\nu_0} \cdot \frac{c^4}{H_{universe\ present}} \cdot \frac{\pi \cdot R_{Earth\ mean}}{G \cdot M_{universe\ primordial}}, \quad (55)$$

which is numerically:

$$g_{univ.primord.} = 3.141592653 \cdot \frac{80.77608713 \cdot 10^{32} m^4 \cdot s^{-4} \cdot 3.141592653 \cdot 6.371005 \cdot 10^6 m}{12.994509779 \cdot 10^{25} m \cdot 6.673848 \cdot 10^{-11} m^3 \cdot kg^{-1} \cdot s^{-2} \cdot 6.487724 \cdot 10^{-5} kg} = 9.02738419 \cdot 10^{29} m \cdot s^{-2}. \quad (56)$$

This calculated primordial gravity result is equal with the product of the eq.38.

For the sake of completeness, the fictive gravity of the present universe could be provided by using the present radius and mass of the cosmos:

$$g_{universe\ fictive} = \frac{\nu - \nu_0}{\nu_0} \cdot \frac{c^4}{H_{universe\ present}} \cdot \frac{\pi \cdot R_{Earth\ mean}}{G \cdot M_{universe\ present}}. \quad (57)$$

In the case of simmetry, calculating by the present radius and mass and of the cosmos the fictive g would be very small, which is numerically the following:

$$g_{univ.fictive} = 3.141592653 \cdot \frac{80.77608713 \cdot 10^{32} m^4 \cdot s^{-4} \cdot 3.141592653 \cdot 6.371005 \cdot 10^6 m}{12.994509779 \cdot 10^{25} m \cdot 6.673848 \cdot 10^{-11} m^3 \cdot kg^{-1} \cdot s^{-2} \cdot 5.497622 \cdot 10^{53} kg} = 1.06531837 \cdot 10^{-28} m \cdot s^{-2}. \quad (58)$$

The density of the primordial cosmos calculated on the basis of the size and mass of the primordial universe

Determining the size and mass of the primordial universe (eq.49 and eq.52) from the original equation (4), the density of the primordial cosmos can also calculated. As the initial density of the cosmos is the ratio of its primordial mass and volume:

$$\rho_{universe\ primordial} = \frac{M_{universe\ primordial}}{V_{universe\ primordial}} = \frac{M_{universe\ primordial} \cdot 3}{4 \cdot h_{h_{h\ primordial}}^{3} \cdot \pi}, \quad (59)$$

therefore:

$$\rho_{universe\ primordial} = \frac{6.4877 \cdot 10^{-5} kg \cdot 3}{4 \cdot (1.5334 \cdot 10^{-32} m)^3 \cdot 3.1416} = \frac{19.4631 \cdot 10^{-5} kg}{4 \cdot 3.6055 \cdot 10^{-96} m^3 \cdot 3.1416} \approx 4.29 \cdot 10^{90} kg \cdot m^{-3}. \quad (60)$$

If the primordial mass would spread in the present volume of the cosmos, the fictive density would be the following:

$$\rho_{universe\ fictive} = \frac{6.4877 \cdot 10^{-5} kg \cdot 3}{4 \cdot (12.9945 \cdot 10^{25} m)^3 \cdot 3.1416} = \frac{19.4631 \cdot 10^{-5} kg}{4 \cdot 2194.2126 \cdot 10^{75} m^3 \cdot 3.1416} \approx 7.05 \cdot 10^{-84} kg \cdot m^{-3}. \quad (61)$$

Final thoughts

On the basis of the method described herein, using not only the Einsteinian equations and principles but applying them for a specific situation, it seems to be possible to more concretely describe the universe. In correlation with the expanding universe, including the Earth with its parameters and the classical universal constants, the above proposed equation proves pertinent to the model of the cosmos from various aspects. The equation can be reformed to other inside parameters allowing significant factors of the physical world to be expressed. Furthermore, by replacing the results of the macro-world data in the equation, exclusive parameters of the primordial universe may be determined.

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Figures are non-proportionate.

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