Cosmos 2.0

An Innovative Description of the Universe

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Abstract. The author's starting point is the axiom that the product of the mass of the proton, the mass of the electron and the square of the gravitational constant (m_e*m_p*G^2) is constant and that the two particle masses would increase while the gravitational constant would reduce over time. With this assumption, the author manages to explain the cosmic redshift without presupposing an expansion of the cosmos.

He presents an underlying relation between the fundamental natural constants, the Hubble constant and the two particle masses, which would describe in quantitative terms not just the beginning, but also – and this is what is momentously new about this model – the end of the universe as we know it. Via a mathematical link, the temporal change in the gravitational constant and the particle masses is described in relation to the Hubble constant. In this context, attention must also be paid to the way in which the change of the electron mass affects the definition of the SI units for length and time.

In addition, the author uses an analogy between magnetism and electricity in which the electron and the proton are considered as the two ends of an electrical dipole string. He develops a model for the elementary unit of the so-called dark matter through which the rotation characteristics of galaxies can be explained.

On the basis of this assumed fundamental relation, the author quantifies the mass and length of the supposed elementary electrets, thus estimating the number of elementary electrets that should cross a typical galaxy. With his model, the author is the first to design a concrete and compact proposal for solving the greatest mysteries of cosmology.

$m_x G = constant$

Proton m_p

Electron m_e

$m_x^2 = m_e \times m_p$

Dark Matter = Electret m_x

$m_x^3 = e^2\, h\, H/4\, \pi\, E_0\, c^2\, G$

$dG/G^2 = H_n/G_n * dt$ n=now

$m_x = m_{xn} * (1 - H_n t)$ t = time from past to now

Investigation:

As already investigated systematically in the author's previous work "The Code of Nature", the value of the mass of the electron and the proton (m_e and m_p) can be represented in a convincing manner by five constants of nature plus a time-varying parameter. The five constants are the elementary electric charge e, the electric field constant ϵ_o, the Planck constant h, the speed of light c and the gravitational constant G (see [1]). As such a time-varying parameter, either radius R_V of the visible universe or – as suggested here by the author – the Hubble constant H could be used. The straightforwardness and simplicity of the relation as found by the author

(1) $m_e^3 * m_p^3 = (e^2 h/4\pi\, \epsilon_o\, c\, G\, R_v)^2$ or $m_e^3 * m_p^3 = (e^2 h\, H/4\pi\, \epsilon_o\, c^2\, G)^2$

speak for themselves.

It is now the author's intention to derive and interpret these relations systematically. The starting point for this process is the following axiom:

(2) $m_x G = \text{constant}$

from the point of view of a distant observer, where m_X^2 is the product of m_e and m_p. The relation should not apply in a trivial manner, i.e. in that the mass of the electron and the proton as well as the gravitational constant are constant. Rather, only the product of these terms as defined above should be constant. This means that any increase of m_e and m_p or m_x entails a corresponding decrease of G and vice versa.

Naturally, this assumption breaks with a lot of taboos – something that the author has shied away from in "The Code of Nature" with his statement "Currently, there are also no hard facts that speak against the constancy of the gravitational constant G, so that (for now) we have to work with a constant value of all five mentioned constants." Now, however, there are enough reasons to take things further, as will be demonstrated later on.

Assuming (2), we may ask the following question: At which value of G - let's call it G_o - does the Compton wavelength $\lambda_x = h/cm_x$ of m_x reach the size of the universe; in other words its radius R_u? This radius R_u is not to be confused with Radius R_v of the visible universe as mentioned above, which may naturally be smaller than R_U. The corresponding equation is:

(3) $G_o = m_x G c R_u/h$

To be able to solve (3), we need a second equation for G_o and R_U. This would be:

(4) $n/V = R_u^2 c^3/G_o h V$

n/V in (4) is the average number of protons or electrons per cubic meter in the universe. $V = 4R_U^3\pi/3$ in (4) is the volume of the universe. (4) means that the number of particles is of the same magnitude as the maximum possible number of bits in a volume of space with radius R_u. Cf. the work of Jacob D. Bekenstein [2].

From (3) and (4) arises

(5) $R_u^2 = 3c^2/4\pi G m_x * V/n$

and

(6) $G_o^2 = 3c^4 G m_x/4\pi h^2 * V/n$.

What is remarkable about G_o and R_U is that the quotient

(7) $G_o / R_u = c m_x G/h$

remains constant, i.e. independent of n/V, if we assume axiom (2).

A second interesting question raised by axiom (2) is: At which value of G – let us call it G_e – does the strength of the gravitation between an electron and a proton reach that of the electromagnetic force between these two particles? It must be borne in mind that, if G reaches the value G_e, m_x also reaches the value of m_{xe}, in accordance with (2):

(8) $m_{xe} G_e = m_x G$

This supplies the relation for the equality of gravitation and electromagnetism:

(9) $m_{xe}^2 G_e = e^2 / 4\pi \epsilon_o$

This results in

(10a) $G_e = G^2 m_x^2 4\pi \epsilon_o / e^2$

or

(10b) $G/G_e = e^2/4\pi \epsilon_o G m_x^2$

G/G_e corresponds to the current ratio of the strength of electromagnetism to gravitation and is 2.27×10^{39}. A striking feature of G_e is that, due to axiom (2), the value of G_e in contrast to G_o and R_u is independent of the density of particles in the cosmos and depends only on the constant product of $m_x G$ (see (10a)).

Multiplying (7) with (10b) results in the equation

(11a) $G_o / R_u * G_e/G = c m_x G/h$ * value Ge/G

By expanding (11a) with the term c/G, we get

(11b) $c G_o G_e / R_u G^2 = c^2 m_x/h$ * value Ge/G

As we can see, the term $c^2 m_x/h$ corresponds to the Compton frequency ν_{mx} of m_x in accordance with the generally valid quantum mechanical relation $E_{mx} = c^2 m_x = h\nu_{mx}$. The value of ν_{mx} is 5.29×10^{21} s^{-1}. Multiplication with the value of 4.41×10^{-40} for G_e/G yields the total value of 2.33×10^{-18} s^{-1} for $c G_o G_e / R_u G^2$. But 2.33×10^{-18} s^{-1} is obviously the measured value of the Hubble constant H, which is why (11b) can be expanded to

(12a) $c G_o G_e / R_u G^2 = c^2 m_x/h * G m_x^2 4\pi \epsilon_o / e^2 = H$

or

(12b) $m_x^3 = e^2 h H / 4\pi \epsilon_o c^2 G$

If we remember that m_x^2 is m_e*m_p, we will find that (12b) is identical with (1), the equation obtained by the author through systematic dimensional analysis. As we see (1) can be traced back to axiom (2). What does that mean in terms of the temporal evolution of m_e, m_p and G, and how is this consistent with the redshift represented by the Hubble constant H?

First we must note that a temporal change of the electron mass will cause a time variation of the so-called Rydberg frequency that describes the light emission of hydrogen:

(13) $$\nu = (1/n^2 - 1/m^2)\,\nu_R$$

ν is the frequency of light when the electron of the hydrogen changes from the m^{th} to the n^{th} energy level. ν_R is the Rydberg frequency.

(14) $$\nu_R = m_e e^4/8\epsilon_o^2 h^3 = 3.2898\text{x}10^{15}\ s^{-1}$$

ν is thus directly proportional to m_e. Between the cosmic redshift represented by the Hubble constant and the temporal change of the electron mass, there must therefore be a direct connection that fits in with (1) or (12b).

A look at (5) $R_u^2 = 3c^2/4\pi Gm_x *V/n$ shows that R_u – the radius of the universe in our model – in addition to the constant c and the term Gm_x (which is constant in accordance with Axiom (2)) only depends on the density of particles n/V.

First, let us examine the case of a constant particle density in the universe. In this case, according to (5), a constant radius of the universe has to be assumed. The redshift of the universe then has to be explained solely by the change of the electron mass which has to increase with time. In fact, when we observe a distant cosmic object, a lower frequency should be measured according to the redshift of the light emitted by this object. (14) therefore requires a lower electron mass for the past.

With regard to the relation between the mass of the proton and the electron, which is 1,836.15, it has to be taken into account that the frequency of certain molecular clocks depends on this relation. In the laboratory, no time delay could so far be measured between such clocks and atomic clocks, whose frequency does not depend on this relation. We thus have to assume that this relation is constant. (Cf. also the work of Ekkehard Peik from the Physikalisch-Technische Bundesanstalt in Braunschweig [3]).

However, the frequency of both molecular and atomic clocks depends on the Rydberg frequency. When a change of the mass of the electron and the proton occurs over time and by the same factor (and thus with a constant ratio of 1,836.15), causing a change of the Ryberg frequency, clocks in the laboratory (i.e. in spatial proximity), show no time delay.

But if we compare "astronomical" clocks, such as faraway galaxies located from us at differing distances, we will notice the temporal change of the electron mass in the form of differing redshifts. Effectively, we are comparing two clocks with different Rydberg frequencies.

The question is thus whether we can put down the cosmic redshift in purely mathematical terms to a changing electron mass, or whether we also have to assume an expansion of space (of the universe)?

To answer this question, we first want to express the redshift ($d\lambda/\lambda$) as a function of the (alleged) Hubble constant H. λ is the wavelength of the measured light:

(15a) $d\lambda/\lambda = Hdt$

or

(15b) $c^*d\lambda/\lambda = Hdx$

dt is the differential of the runtime of the light from the observer to the observed object; dx is the differential of the distance between observer and observed object. These relations apply to both the redshift as a result of space expansion and the redshift as a result of a temporal change of the Rydberg frequency with alleged H.

If we replace the wavelength λ with the frequency ν of light ($\nu = c/\lambda$), (15a) and (15b) become

(16a) $d\nu/\nu = - Hdt$

and

(16b) $c^*\ d\nu/\nu = - Hdx$

In the case of redshift occurring exclusively as a result of changes in the electron mass and by taking into account axiom (2) and the constancy of 1836,15, (16a) and (16b) can be transformed into

(17a) $dm_x/m_x = - Hdt$

and

(17b) $c^*dm_x/m_x = - Hdx$

or

(18a) $dG/G = Hdt$

and

(18b) $c^*dG/G = Hdx$

Before we tackle the integration of equation (18a) or (18 b), we have to prove (1) or (12b) – $m_x^3 = e^2hH/4\pi\epsilon_o c^2G$ – with a view to the constancy of the terms contained therein. As already discussed above, a change of the particle masses cannot be detected directly in the laboratory by comparing clocks, but only indirectly via the redshift of distant objects. This becomes obvious if we take into account the fact that the SI unit of mass is based on the Primary Kilogram, which is subject to the same time changes as the particle masses.

Concerning the constants e, ϵ_o, h, c, which form the so-called fine structure constant α ($\alpha = e^2/2\epsilon_o ch$), it should be noted that both the comparison of clocks in the laboratory and the current cosmological observations speak for the constancy of α and the four constants forming α.

According to (14), the Rydberg frequency increases in proportion to electron mass. According to the SI-definition, a second is the duration of a multiple of the period of the electromagnetic radiation corresponding to the transition of an electron between two hyperfine levels. The frequency of this hyperfine radiation is also proportional to the

Rydberg frequency and therefore increases with time. The increase in frequency causes a shortening of the hyperfine period. That is why the second, being a multiple of the hyperfine period, becomes shorter with time.

According to the SI-definition, the meter is the distance travelled by light in a tiny but fixed fraction of a second. Therefore, if the second shortens, the meter shortens proportionally to the second.

If we assume – in accordance with the above outline – a constant particle density and a constant radius of the universe, measured in current meter units, the middle distances between the galaxies, measured in current units, are also constant.

In spite of this, due to the steady shortening of meter units, measured distances between the galaxies will increase steadily in future - an amazing effect of changing electron mass, which we would subjectively perceive as space expansion.

Even if the measured redshift between two galaxies in accordance with equation (16b) and due to the constant middle distance in the universe were to be constant – and this would require a constant rate of change of the electron mass, measured in the current time unit – another value of the Hubble constant (H_1) would in future be determined as a result of the shortened meter unit (dx_1) - ($c^* d\nu/\nu = - Hdx = - H_1 dx_1$).

This means that, in order for (12b) - $m_x^3 = e^2hH/4\pi\epsilon_o c^2G$ to be valid in future with an apparently constant m_x, but a variable Hubble constant H, given the changing measuring units, the term H/G must remain apparently constant if the constants e, ϵ_o, h, c, from which α is composed, also remain constant.

So if (18a) - $dG/G = Hdt$ – is integrated, it must first be expanded to

(19) $$dG/G^2 = H_n/G_n{}^*dt$$

H_n and G_n are the currently measured values of the Hubble and the gravitational constant, assuming that $H/G = H_n/G_n$ = apparently constant. Since H_n/G_n is not time-dependent, (19) can be integrated by a proper definition of integration boundaries

(20a) $$G = G_n/(1 - H_nt)$$

t is the amount of time that has passed, while G in the past has been reduced to its present value G_n. Allowing for (2), (20a) can be transformed into

(20b) $$m_x = m_{xn}{}^*(1 - H_nt)$$

t in (20b) is the amount of time that has passed while m_x has increased to m_{xn}. With (20a) and (20b), the temporal development of G and m_x has thus been found. The currently measured Hubble constant H_n in (20a) can be replaced by $H_n = 4\pi\epsilon_o c^2G_nm_{xn}^3/e^2h$ from (12b). This results in

(21a) $$G = G_n/(1 – [4\pi\epsilon_o cG_nm_{xn}^3/e^2h]^*ct) = G_n/(1 – ct/R_v)$$

assuming that:

(0) $$m_{xn}^3 = e^2h/4\pi\epsilon_o cG_nR_v$$

Equation (0) is the form of equation (1) or (12b) originally arrived at by the author through systematic numerical analysis. R_v is the radius of the currently visible universe and must not be confused with R_u, the radius of the universe in total. With the exact values of the fundamental constants we arrive at a value of 13.59 billion light years for R_v.

In the same way as (20a), (20b) can be transformed into

(21b) $$m_x = m_{xn}*(1 - ct/R_v)$$

What progression of redshift z will result from (21b)? The redshift, with respect to the terminology used here, and taking into account that ν is directly proportional to m_x, is defined as follows:

(22) $$z = \Delta\lambda/\lambda_n = \nu_n/\nu - 1 = m_{xn}/m_x - 1$$

Through a combination of (21b) and (22), we arrive at

(23) $$z = ct/(R_v - ct) = x/(R_v - x)$$

x is the distance between the observed object in the universe and its observer and t is the time the light needs to travel from the observed object to the observer. If the value of t approaches $T=R_v/c$, i.e. the time the light needs to pass through to the radius of the visible universe, then the redshift is aiming toward infinity.

This is to be expected, because for us as current observers, the opaque horizon is at a distance R_v. From $t = T/2$ corresponding to $x = R_v/2$ follows $z = 1$ and $m_{xn}/m_x = 2$. So far, the largest measured redshift of 10.3 corresponds to the values $x = 0.91\ R_v$, $t = 0.91\ T$ (~ 12.37 billion years) and $m_{xn}/m_x = 9.3$.

A universe which, in contrast to the model shown here, had been expanding at a constant speed for $T = 1/H_n$ years, would have the same progression of redshift as (23). However, this would signify that the model could explain the measured redshift – as adopted above – only through the continuous change of the electron mass.

Does this mean that both models – the expanding universe and the model based on a temporal change of the electron mass that is shown here – are indistinguishable for an internal observer, since, as already discussed, the change of the particle mass could be registered as an apparent expansion by such an internal observer? Is the word “apparent” really appropriate in this context? Is there not a real equivalence between the two models?

If we were to consider only the redshift between widely separated cosmic objects, both approaches would appear equivalent. However, when we look at objects that are located close together, there would have to be a significant difference.

In the case of the expanding universe, there are areas which are not subject to the expansion, because the local gravitation binds these objects strongly to each other, keeping them at a constant distance and preventing them from drifting apart. In particular, such areas include stellar systems like our own solar system with its planets, but also galaxies such as the Milky Way galaxy. However, this means that such areas are not subject to space expansion and thus exempt from the Hubble constant. Within these systems, there only the gravitational redshift according to the general theory of relativity applies.

In the model presented here, instead of the redshift as a result of space expansion, a redshift occurs as a result of the permanent change of the electron mass. This redshift is proportional to the distance from the observer and also occurs within gravitation-bound local objects. For example, this redshift according to (23) at the distance earth-sun is ~ 10^{-15}, which is still below the accuracy or detection limit. At a distance of at least one light year, this redshift lies at ~ 10^{-10}, which should be detectable.

What is the impact of such a change to the gravitational constant on the mechanics of celestial bodies and the gravitational redshift? To investigate this, let us first take a look at the rotation speed of and arounding celestial bodies.

(24) $$v^2 = GM/r$$

Because the product Gm_x is constant and composite bodies of mass M in turn consist of a certain number of elementary particles, mass M changes in the same way as m_x, thereby implying that GM is constant. It must also be considered that the kinetic energy of the electrons in the atoms contribute to the total mass ($m = E/c^2$). But because the electron energy is also proportional to the Rydberg frequency and the electron mass, the proportionality as a whole is maintained. If the product GM does not change, v^2 also remains constant – and thus also the motion of the celestial bodies.

Concerning the gravitational redshift, the relevant formula of the general relativity should also be discussed:

(25) $$\nu' = \nu(1 - GM/c^2r)$$

The frequency ν of light is reduced to ν' according to (25), if it leaves a celestial body of mass M. Here, too, no change of the gravitational redshift occurs because of the constancy of GM.

Comparing the formula for the gravitational redshift of general relativity in a homogeneous gravitational field (gravity g = constant)

(26) $$\nu' = \nu(1 - gx/c^2)$$

with (20b), $m_x = m_{xn}*(1 - H_nt)$, and taking into account that $t = x/c$ and ν in (20b) is proportional to m_x, we notice the similarity in the structure of (26) and (20b). The redshift in the model according to the change of electron mass has the same course as the gravitational redshift in a homogeneous gravitational field to which the value $g = cH_n = 6.99\text{x}10^{-10}$ m/s^2 applies.

In other words: If a spacecraft leaves the solar system, its radio signals will, due to the change of electron mass, be subject to an additional redshift, which will give the impression of the spacecraft decelerating by a g of ~ $7\text{x}10^{-10}$ m/s^2, although, in real terms, no such deceleration would occur. What we observe is simply the additional redshift.

What role does the law of conservation of energy play in our model? To answer this question, we first have to discuss what the apparent time-dependent development of the gravitational constant looks like from the point of view of an internal observer, whose measuring standards change with the electron mass.

By comparing gravity with electromagnetism, internal observers will determine – over very long periods and in accordance with (10b) – a change in the ratio $k = G_e/G$ of the two forces:

(27) $$G = e^2/4\pi\epsilon_o m_x^2 * k$$

Because, in accordance with (20a), $G = G_n /(1 - H_n t)$ – G was stronger in earlier times, $k = k_n (1 - H_n t)$ used to be smaller. The internal observer, as has already been shown, does not register the temporal changes of m_x and other masses due to the mass standards of comparison.

But, in accordance with (27), such an observer will find that that $G_{app} = G_n (1 - H_n t)$ is proportional to k and used to be weaker instead of stronger. G will apparently increase in future. In addition, the distance between attracting masses was also shorter in earlier times, and due to the shortening meter standards in accordance with $r_{app} = r_n (1 - H_n t)$, it will increase in future.

Now we can visualise the development over time of the potential energy of a two-mass system:

(28) $$E_{pot} = - G_n Mm/r_n = - G_{app} Mm/r_{app} = \text{constant}$$

The development over time of the kinetic energy of mass m, which is spinning around M, can also be visualised:

(29) $$E_{kin} = mv^2/2 = G_n Mm/2r_n = G_{app} Mm/2r_{app} = \text{constant}$$

The law of conservation of energy is untouched by the small changes over time that occur according to axiom (2) and will continue to apply in full.

What are the other differences between the representational model and the traditional model of the expanding universe with constant G?

The validity of (21a) and also of (21b) in the past must be limited at least at G_o, because at G_o the Compton wavelength of the elementary particles reaches the value of the size of the universe itself. This does not mean that their validity should not be limited to an even earlier point for other reasons.

In addition, at a far-distant future – aeons, measured from now – G will reduce to G_e, but m_x^2 in accordance with axiom(2) will increase to m_{xe}^2 and the strength of the gravitational force will reach the electromagnetic force because the product $m_{xe}^2 G_e$ will become greater than ever before. Then at the latest, our familiar world of charged particles will cease to exist; matter will compact and result in many small black holes, probably sub-universes.

It is precisely this aspect that makes the present model so momentous in its implications: **It is the first-ever model of the cosmos that is able to describe not only its**

very beginning, but also its end. In accordance with the model, the world as we know it starts as a kind of condensation process of dark uncharged quantas into charged matter as soon as the gravitational constant (gravitational variable) decreases to a certain value and the gravitational force exceeds a certain value (the process of **primal condensation**).

At the very latest, the world as we know it will come to an end when the value of the gravitational constant decreases to a second specific value or the gravitational force exceeds a second certain value and the loaded matter as a whole starts compacting into many small black holes (the division of the cosmos into many small **subcosmoses**).

A partial analogy to the double phase transition of ordinary matter comes to mind: first, the condensation of gases to liquids and then the solidification of liquids to solids. One with falling temperatures, the other with the decreasing value of the gravitational constant or gravitational variable G.

The model of the cosmos found by the author can replace the traditional model of the expanding universe by explaining the measured Hubble constant with the temporal change of the electron mass. But what about the so-called dark matter, still of unknown nature, postulated by the standard cosmology, which is used for explaining the motion of galaxies? Can the author's formula also shed some light on this phenomenon?

In "The Code of Nature", the author suggested that mass m_x could also represent dark matter. Now, the author is able to concretise this assumption.

As a first step, an analogy between electricity and magnetism must be drawn up and applied. Each magnet has a north pole and a south pole and the field lines of a magnet are closed. Outside of the magnet, the field lines run from the north to the south pole and within the magnet from the south to the north pole. Electrical elementary charges, however, are – in the conventional view – positively or negatively charged monopoles. The electric field lines are not closed and run in this view from the proton to the electron.

Instead of searching for magnetic monopoles – which have meanwhile been detected in the form of quasi-particles in a special kind of matter, the so-called spin-ice [4] – the author takes the opposite direction and asks: Could electrons and protons not be the ends and poles of an elementary electret, where the electrical field lines inside this electret run from the electron to the proton and are also closed lines? Could such an elementary electret be the elementary particle of the dark matter? A fascinating idea that offers tempting possibilities for further development !

By the way, the term electret was created by the British physicist Oliver Heaviside and is used for permanent macroscopic electric dipoles.

So, if protons and electrons are the ends of open electrical loops and these loops represent dark matter, how big is the mass of such a loop, calculated without the mass of the electron and the proton?

In this context, the author presupposes that the mass of the dark electret is m_x, where m_x^2 is the product of m_e and m_p and can be described also by equation (1) or (12b) as follows:

(12c) $m_x = e^2hH/4\pi\epsilon_o c^2Gm_x^2 = hH/c^2 * e^2/4\pi\epsilon_oGm_x^2 = hH/c^2 * G/Ge$

The term $hH/c^2 = m_H$ has the dimension of a mass with $1.72x10^{-68}$ kg. The Compton wavelength of this mass $\lambda_{mH} = h/cm_H = c/H = R_v$. The Compton frequency c^2m_H/h of the mass m_H is of course H. This means that the Hubble constant can be associated with a mass whose Compton wavelength is the Radius R_v of the visible universe. The ratio of m_x to this mass m_H is equal to the ratio of the strength of electromagnetism to gravity with the sum $G/Ge = e^2/4\pi\epsilon_oGm_x^2 = 2.27x10^{39}$.

Since the Compton wavelength of m_H is equal to the radius of the visible universe, it is assumed that the loop length of the elementary electret is also R_v. Elementary electrets are thus cosmic strings with a mass m_x ($3.9x10^{-29}$ kg) and length R_v ($1.28x10^{26}$m). Their specific mass is therefore $3.05x10^{-55}$ kg/m.

Do these claims conform to the motion of galaxies? In principle, yes – because the reason for the introduction of the concept of dark matter was the observation that the rotation speed of stars from a certain radius to the centre of the galaxy remains constant. In accordance with equation (24) $v^2 = GM/r$, a rotation speed independent of radius r requires that mass M be proportional to r, so M = k*r, whereas k has the dimension kg/m.

Strings that leave the galaxy starting from an elementary particle or strings that only traverse the galaxy and start from other galaxies fulfil this condition precisely. Electrets in the form of cosmic strings can qualitatively explain the rotation performance of galaxies. But do the quantitative conditions also fit?

A typical galaxy features a constant rotation speed of around 150 km/s (= $1.5x10^5$m/s) at a distance of 5 kpc (= 1.55 $x10^{20}$m) from its centre. According to formula (24), the mass of the galaxy within 5 kpc must be approximately $5.2x10^{40}$ kg.

In order for the rotational speed to remain constant, the mass per spherical shell of 5 kpc thickness shall be also approximately $5.2x10^{40}$ kg at a greater distance from the centre. That means k = $5.2x10^{40}$ kg/$1.55x10^{20}$m = $3.4x10^{20}$ kg/m. Because the supposed electret has a specific mass of $3.05x10^{-55}$ kg/m, approximately 10^{75} electrets or strings must leave or pass through the galaxy.

A galaxy with about $5x10^{40}$ kg of visible matter contains approximately $3x10^{67}$ protons and electrons, each being the end point of an electret leaving the galaxy. Based on this, $10^{75}/3x10^{67}$ = 33 million times more electrets pass a typical galaxy than start in it. A galaxy is thus a huge tangle of dark cosmic strings formed by gravitation.

As the visible universe should contain about 100 billion (= 10^{11}) galaxies, a typical galaxy should be traversed by approximately 0.3 per mille of all electrets originating in the visible universe – a truly gigantic network. As we can see, there are no facts that would quantitatively conflict with the assumption of the author. Reason enough for further investigations into this matter.

Conclusion

The model of the author explains the cosmic redshift through a temporal change of the mass of the electron instead of an expansion of cosmic space. The major difference to standard physics is that the mass of the proton and the electron can be represented by a function of five fundamental natural constants and the Hubble constant. Using the function found by the author, not only the masses of the two most important particles, but also the temporal evolution of the universe including its end can be described.

In addition, the deduced equation also describes and quantifies the nature of dark matter. In accordance with the theory of the author, protons and electrons, together with dark matter electrets, form permanent electric dipoles, the electrical counterpart to magnets. The electric strings of cosmic extent which connect protons and electrons represent the dark matter that cosmologists are looking for and also causes the characteristic rotation of galaxies, which cannot be explained by visible matter alone.

References

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