

Static Universe: Infinite, Eternal and Self-Sustainable

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To the memory always present from my dear nephew Alejandro Graniel López, now in communion with the infinite Universe...

In this work, we present a study like a “stellar dynamics” model of an infinite Universe, in which the matter distribution follow a relationship inversely proportional to the square power with respect to the distance from the center of rotation of cluster and supercluster of galaxies (that have a common centre of rotation). In this study, we considered that the Universe have infinite centers similar in structure and in dynamic equilibrium between them. The stars in the galaxies are supposed to be homogeneously distributed with a spherical symmetry and with an average radius and, in turn, the galaxies in the Universe. Also, we consider a smoothed potential of this kind of universe and study the effect of gravity in the radiation of the stars: applying the equivalence principle we obtain a mathematical expression for the Hubble’s law and a formula for its redshift that could explain this phenomenon like a gravitational effect. Also we obtain an approximated calculation of the Cosmic Background Radiation (CBR), taking as hypothesis that this radiation is the light of all stars in the Universe that arrive until us with an extreme gravitational redshift. In conclusion, we present here an alternative explanation for the redshift and CBR, like an alternative to the presented by the Big Bang theory, or Steady State theory, postulating in consequence a new theory about the structure of the Universe: static, infinite, eternal and self-sustainable.

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1. INTRODUCTION

How is the Universe? What is its structure? Is it eternal? Or, did it have a beginning? And it will have an end? Is it infinite? Or, has it a limit? These are questions that the human being does about the Universe since he has conscience from this, and his position in it, and that until now us tries to respond. We have created different cosmogonies trying to obtain some answers, but the questions still remain.

The first scientific theory which was able to give answers properly, and that gave rise to a cosmology, was the Newton’s Mechanics. He supposed a space with a Euclidian geometry and an absolute time for the entire universe. A space like a passive scene where all the physical phenomena are developed, and that are governed by their Universal gravitation’s law, besides its three laws of motion. According to this, the massive bodies act to each other by means of a gravity force in an instantaneous way, without anything that mediates it. Newton also believed, according to his theory, that the Universe was static and infinite.

According to it, the matter in the Universe was in balance because its distribution was uniform and infinite, in such a way that each of the stars is balanced with its neighbors, by the entire universe. Thus, these stars remained in balance, although unstable. In its own words, in a correspondence maintained with Richard Bentley [1]:

The Lord affirms that all particle of matter in an infinite space has an infinite amount of matter of all the sides and, consequently, an infinite attraction by all part, having therefore to remain in balance because all the infinities are equal.

And later, in another letter, he adds, agreeing with the idea of Bentley that although this infinite system is in balance, is unstable, like needles placed vertically:

Therefore, when I say that the equally dispersed matter by all the space would be added by its gravity in one or but immense masses, would understand that this would be a matter that would not remain in rest in a precise balance.

This mechanical and fragmentary vision of the Universe would remain for approximately two centuries, until Einstein (1917) proposed its own gravitational theory in his General Theory of Relativity. In the Einstein's vision of the Universe, the space, time and matter are constituent not separated, but continuous where one of it influences on the other in a global dynamic evolution [2]:

*When forced to summarize the general theory of relativity in one sentence: **Time** and **space** and **gravitation** have no separate existence from **matter**. ... Physical objects are not in space, but these objects are spatially extended. In this way the concept 'empty space' loses its meaning, ... Since the theory of general relativity implies the representation of physical reality by a continuous field, the concept of particles or material points cannot play a fundamental part, ... and can only appear as a limited region in space where the field strength / energy density are particularly high.*

According to his theory, the geometry of space is described by the Riemannian geometry of four dimensions: three spatial and one temporal. He proposed his field's equation that relates the distribution of matter and the energy with the curvature of this space-time. In addition, he proposed the Perfect Cosmological Principle, thinking that in small scale the matter of Universe is irregularly distributed, but in a great scale it reaches a homogenous distribution. Applying his equation to this kind of Universe as a whole, he described its evolution. This idea was important because in this way the great complexity of the equations was simplified and was possible to find solutions in some cases, that otherwise would be impossible to resolve. Besides he added a cosmological constant, which physically represents a repulsive force that balances the gravity force and avoids that all matter falls towards its centre. The solution of this equation allows us to describe a static Universe: without some global movement or expansion with respect to someone center of balance.

Later, in 1922 Friedman found that this static Universe wasn't the unique solution. He discovered that the cosmological constant was not sufficient to maintain the system in balance, because any disturbance and the Universe expands or contracts, depending of the density of its matter. In this model of the universe, therefore, an equilibrium point doesn't exist, but a fight of forces that determines if this one expands or is contracted. That fight could be eternal and/or to have a beginning in the past (as George Lemaitre together with Friedman proposed in 1929) where all the matter and energy would be concentrated in a singular point and it would initiate its expansion caused by a great explosion. This class of

universe, the Big Bang Theory (BBT), as it were named by Fred Hoyle, acquired credibility when Hubble detected a redshift in the light of distant galaxies [3], and they considered that this effect was caused by separation with high speed of the galaxies.

According with us, the BBT proposes an irrational Universe, since the initial conditions of this singularity are difficult to determine, and therefore is impossible according to this, to be able to obtain a causal explanation about the evolution of the Universe. Perhaps this was the principal reason that leads to Thomas Gold and Hermann Bondi (1948) to propose the Steady State theory (SST) of Universe [4]. Their theory also modeled a Universe in expansion just that this doesn't have a beginning; but as the matter expands, there is loss of density by its expansion (with a velocity according with the Hubble's law). To compensate this loss, Thomas Gold proposed a C field that creates matter with a continuous rate of one atom of hydrogen by cubic meter every 10^{10} years around the entire Universe [5]. This would allow that an infinite universe always conserves the same structure, isotropy and homogeneity, and in this way the Perfect Cosmological principle is preserved. The main objection to this model was that it does not preserve the conservation of energy, although the BBT neither. The SST lost credibility when the cosmic background radiation (CBR) was detected; the BBT won credibility because they explained that this radiation was remnant of big bang. CBR together with the redshift are the fundamental pillars that give sustenance to the BBT.

Authors of the SST argued that CBR could be due to the light of old stars scattered in its travel by the interstellar material contained inside the galaxies [6]. The problem with this explanation is that this radiation doesn't have the polarization that must have the light that is dispersed; besides this radiation is a perfect black body than difficultly could be formed by superposition of radiation with different redshift [7].

A new theory tries to mediate between both explanations (BBT and SST), and proposes a Universe that eternally expands and contract, in an infinite series of big-bang and big crunch and it's known like quasi-steady state theory (QSTT, 1993) [8].

However, exist a third alternative to these, developed by Regener, Nersnt, Finlay-Freundlich, Max Born and de Broglie. They considered that the Universe is static and infinite, and that the redshift of light of the stars is caused for an effect named "tired light" [9].

Recently, it is tried to describe the structure of the visible Universe observed like a distribution of matter organized in cluster at different levels of hierarchy, by mean of the mathematic of fractals [10, 11,12]. Also its structure is analyzed with correlation theory, similarly how is applied to the analysis of the structure of liquids [13, 14].

2. THE MODEL

In this work we present an alternative explanation for the measurements of the redshift and the cosmic background radiation (CBR), and propose as a consequence, a new structure of the Universe. First, this is deduced directly from the astronomical observations, and it is not assumed a priori as in the previous theories with the Cosmological Principle.

We know that distribution of matter in Universe (although in local level it seems non homogenous, or until with certain degree of randomness) follows a structure with a distribution function inversely proportional to the n th power of the distance from its rotation center (to level of galaxy, and clusters of galaxies), and diminishes with exponential

factor of 1.8 [13, 14, 15]. By extrapolation it is possible to suppose that in a larger scale it decreases with a tendency to a distribution following the inverse square law. Maybe the Universe has a kind of fractal structure that follows a power law (although with variance of scale). We propose this class of distribution, because with this model, to certain scale, the matter reaches the homogeneity. We explain this next: the stars are grouped in galaxies, and galaxies in clusters that are grouped also in a set of clusters (named superclusters). In each level all these groups are rotating around their own center (center of mass) similarly like the galaxies do around its own center (where its density of matter could be infinite due to the presence of a super massive black hole [15, 16]. According with our hypothesis, hierarchic levels finish here, and we think that this grouped matter reach its maximum level and has a common rotation center, nominated for us like maximum gravitational rotation center (MGRC). Similarly, for others supercluster we suppose that they follow a similar distribution (this structure could be considered as the bricks of the Universe, i. e., its maximum unity), and that could to exist infinites similar structures in the infinite Universe. Its interaction among them is only a translational force (because not exists another center of rotation at higher level) and exist a local dynamic but static in average at global level, i. e., they are in a dynamical equilibrium. Therefore, in the following scale the matter distribution no longer follows a radial distribution, and although still this seems random, in average its distribution to this scale goes towards homogeneity. Thus, the density moving away radially of this MGRC is decreasing, since on each scale the separation increase: between stars in the galaxies is of the order of parsecs, and between galaxies in the clusters is in the order of megaparsecs [17], and so successively. Then, the uniformity is reached when to some distance R of any MGRC, the density of the proposed distribution function reaches the value of the average density of the Universe ($1.67 \times 10^{-27} \text{ kg/m}^3$). In this scale, the matter inside of each shell of radius $r \geq R$ is constant. Our model try to agree with the astronomers' observation about the structure of universe, where to this scale reach the homogeneity, as it is presented in the Atlas of the Universe site (see Fig. 1) [18].

Summarizing, this infinite system remains in stable equilibrium, since there is not a dominant MGRC, as is proposed in the BBT, and that observationally never was observed. However we propose that exist very much MGRC (we are supposing infinite), and that they are in dynamic equilibrium, between them and with those of the rest of an infinite Universe. This can be deduced directly of the observation, since all centers of gravity imply matter rotating around itself, and some MGRC that dominates the others like a rotation center have never seen. Each MGRC is in dynamic equilibrium with the others, and although is possible that gravitational attraction between two centers dominates to the attraction of the other centers causing a translation, the time that would take a collision is so long due to the great distant among them, that the collision is not common. Besides, the stability of this type of Universe is due that the matter of each gravitational center is rotating or "falling" to its own center, and its time scale is minimally of the order of thousands years. Therefore, although a collision between galaxies is probable, this would takes a long time. For example, a predicted collision Andromeda-Milky Way due to take place in three billions light years approximately [19]. In addition, anywhere part of the Universe is compensated with the movement of other centers, in a dynamic re-balancing of forces, allowing a homogeneous distribution of matter on a large scale.

This model also supposes a self-sustainable Universe because if at local level stars or galaxies are dying; at global level this is balanced with the birth of other stars or galaxies in another place of the same supercluster, allowing that Universe remains homogenous and isotropic for any time. The quantity of matter and energy is conserved, being recycled during the evolutionary process of the Universe, conserving the same state and structure forever. In this case the Perfect Cosmological Principle is not proposed, but deduced from astronomical observations and physical considerations. In our model, unlike the BBT,

without an origin-a birth of the Universe-, the stars and galaxies, in general all the structure of the Universe always has existed. Then, in this work, we are taking like hypothesis that Universe has a constant proportion of matter and radiation in average at global level for any time and place of the space, although this varies locally for each galaxy or cluster. We know that 0.01% of the mass of the stars is converted in radiation during all its luminous life [20] and we know that almost totality of the matter in the Universe is composed of stars; therefore we consider that 0.01% of density of matter in the Universe is radiation.

In this work, we will consider an idealized situation where each star have dimension and mass similar to the sun, homogeneously distributed inside the galaxies (with 10^{11} stars like in a typical spiral galaxy), and a spherical symmetry with an average radius. This galaxies interact gravitationally between then, forming cluster and super cluster, until filaments, etc. following a distribution of matter inversely proportional to the square of the distance, how we explained before. Also, how we did in a previous work [16], we will use a “stellar dynamics” model, where each galaxy contributes to the overall gravitational field and we don’t need to know the precise location of each one. In order to obtain an excellent estimation is necessary only to replace this distribution of individual galaxies by a smoothed continuum density. We know that gravitation is a cumulative force, and then we must use Gauss’ law for to obtain its continuum gravitational field. Therefore, each galaxy follows a ‘collisionless dynamic’ around a MGRC, like in a stationary system, influenced by the global gravitational effect, and with weak influence by the local gravitational effects of nearest stars.

3. SEMICLASSICAL ANALYSIS

In this work we used a semi-classical analysis for to obtain a gravitational field. We consider that by the distance that separates the galaxies, and still greater distance between clusters of galaxies, its gravity force between them is very small, and therefore a semi classical approach is well. In addition, the complexity of the General Relativity equations doesn’t allow a calculation for more than two particles, much less for the type of structures that we propose. Also, the classic analysis allows using for a distribution with radial distribution an average calculation for a distribution of matter, by means of the Gaussian’s law, how we have used already it in a previous work for to obtain the rotational velocities of the spiral galaxies [15].

We will divide our semi-classical analysis in two parts. In the first part, we will propose that the redshift radiation that arrives to us from the galaxies is caused by a gravitational restraining. The study of this effect has its antecedents in a Fritz Zwicky’s work, where he proposes a gravitational “drag” effect for to explain this redshift, and that also it’s known like a tired light effect [21]. In the second part we will try to explain how the CBR is the light of all the stars of an infinite Universe that in their travel through this, it has undergone an extreme redshift, and that arrive until us when they do not collide with others stars.

A) Gravitational Redshift

Our analysis starts considering that the Universe has a distribution of continuous matter, and that it vary from its RGC inversely proportional to the square of its radial distance

$$\rho = \left(\frac{M}{4\pi R} \right) \frac{1}{r^2} \quad (1)$$

where M is the average mass inside the sphere of radio R , and this radius defines the minimum length of the shell in which the density of matter transit to a constant average value. For subsequent layers of similar length (scale), the mass of this distribution will grow in a similar form like its volume: proportional to the square power of r . Therefore its density remains constant for $r \geq R$.

The radial symmetry of this distribution allows, using the Gaussian's law, to calculate its external gravitational field ($r \geq R$)

$$g = - \left(\frac{GMm}{R} \right) \frac{1}{r} \hat{r} \quad (2)$$

where G is the gravitational constant. The photons that travel by any gravitational field of this type have to be affected in its energy, how we know, according with the equivalence principle, the frequency of light is altered in presence of a gravitational field: it is modified (diminished or increased depending its direction with respect the gravity).

Taking MGRC like the origin from our reference system, the distances of the origin to any radiation font (stars in each galaxy) is r' . Therefore the photons travel radially from R until r' (from the border towards transition to homogeneity of the matter distribution of the Universe, see Fig. 2). The calculation of its potential energy will be

$$\phi = \frac{GMm}{R} \ln \frac{r}{R}, \quad (3)$$

where $r = R + r'$, and this potential is positive because the light of stars goes in the opposed direction to the gravitational field. Here m is a fictional "mass" of photon (which is subsequently canceled out).

Now, according to the Einstein's mass-energy relation, the total energy of a photon is

$$E = mc^2 \quad (4)$$

under the influence of the gravitational potential equation (6), it's modified like

$$E' = E + \frac{GMm}{R} \ln \frac{r}{R} \quad (5)$$

or

$$E' = mc^2 + \frac{GMm}{R} \ln \frac{r}{R} \quad (6)$$

where E is the initial energy of the photon ($h\nu$), E' is the diminished energy ($h\nu'$), and h is the Planck's constant.

Also we know that the redshift is measured with a parameter z , defined as

$$z = \Delta\nu/\nu = (\nu' - \nu)/\nu \quad (7)$$

where ν is the frequency of the light emitted by the source, ν' is the light with redshift received. We can rewrite this expression

$$1 + z = \frac{\nu'}{\nu} \quad (8)$$

multiplying by the Planck's constant h , numerator and denominator, we can express this relation like

$$1 + z = \frac{E'}{E}. \quad (9)$$

Then, replacing the value of E and E' of the previous equations (4) and (6) respectively, in eq. (9)

$$1 + z = \frac{mc^2 + \frac{GMm}{R} \ln \frac{r}{R}}{mc^2} \quad (10)$$

therefore

$$1 + z = 1 + \frac{GM}{c^2 R} \ln \frac{r}{R} \quad (11)$$

and we obtain

$$z = \frac{GM}{c^2 R} \ln \frac{r}{R}. \quad (12)$$

So we obtain an expression for the gravitational redshift that we consider as a general expression to the Hubble's law, how we will try to prove next.

This logarithmic expression can be developed like a Taylor's series

$$z = \frac{GM}{c^2 R} \left[\frac{r}{R} - \frac{1}{2} \left(\frac{r}{R} \right)^2 + \frac{1}{3} \left(\frac{r}{R} \right)^3 - \dots \right]. \quad (13)$$

The linear expression is the first approach for the values of its potential near its periphery R , and is the region where the density of the matter reaches or approximates to its constant value. Therefore, in this section we will only take the linear approach

$$z = \frac{GM}{c^2 R^2} r, \quad (14)$$

where this approach will give us a measurement of the gravitational effect on the light to large scale, where the Universe reaches the homogeneity. We will be able to extrapolate this expression for greater distances than R , considering that to this scale the effect of gravity is the same. This could be explained like a global effect of gravity, and that restrain the light

in the same way because in an isotropic Universe there is not difference in the direction or length.

From the Hubble law we know that

$$cz = Hr, \quad (15)$$

and therefore

$$H = \frac{GM}{cR^2}. \quad (16)$$

It's interesting to note that the last equation could help to explain the deviations of predicted trajectories and velocities of Pioneer 10 and 11, out our solar system (well-known like Pioneer anomaly) [22]. The researchers that have studied this effect found a constant sunward acceleration $((8.74 \pm 1.33) \times 10^{-10} \text{ m/s}^2)$ [21]. Also they found that the magnitude of this quantity is very much approximated to the product of the speed of light and the Hubble constant (and also its physical unit is the same). We can rewrite Eq. (16) like

$$Hc = \frac{GM}{R^2} \quad (17)$$

and the right side of this equation express the deceleration that has to have any body with mass, or electromagnetic radiation (like the same the light) caused by the gravity of the matter distribution according with our model to a scale of radius R , and well-known like "drag" effect [22]. Therefore, this explains why the product of H and c express the magnitude and its physical unit of its deceleration.

Now, the value of R can be calculated of equation (17). The data that we need is M and H , where we can to obtain the first directly of definition of density. Considering that on this scale our density function (eq. (1)) must agree with the average density of the Universe, since we are in the zone of its transition to the homogeneity. Therefore we can calculate M , multiplying the average density ρ_0 by the volume of radio R that it occupies

$$M = (4\pi/3)R^3\rho_0, \quad (18)$$

now replacing eq. (18) in the equation (17) we obtain

$$H = \frac{4\pi GR\rho_0}{3c} \quad (19)$$

and clearing R , we obtain

$$R = \frac{3cH}{4\pi G\rho_0}. \quad (20)$$

Now we could to obtain H directly of the graphic of Redshift versus Luminosity Distance diagram [23] (in the scale of Gigaparsecs) considering only a linear approximation, and we obtain the approximate observational value $H=58 \text{ km/s / Mpc}$. With these data substituted in eq. (20) we obtain $R = 1.243 \times 10^{27} \text{ m}$.

Below, we could to obtain an expression, with the known data, for the gravitational redshift. Replacing H of eq. (19) in eq. (16), we obtain

$$z = \frac{4\pi R \rho_0 G}{3c^2} r, \quad (21)$$

and substituting z value in Eq. (11)

$$1 + \frac{4\pi R \rho_0 G}{3c^2} r = \frac{\nu}{\nu'}, \quad (22)$$

we clear ν to obtain

$$\nu = \left(1 + \frac{4\pi R \rho_0 G}{3c^2} r \right) \nu' \quad (22)$$

and finally we found a formula for the gravitational redshift of the frequency of the photons. Also we can express this in function of wavelength

$$\lambda' = \left(1 + \frac{4\pi R \rho_0 G}{3c^2} r \right) \lambda \quad (23)$$

B) Cosmic Background Radiation

According to our hypothesis, and that we will try to prove, the CBR is caused by the spectral radiation of all the stars grouped in galaxies and in cluster of galaxies of our infinite universe.

The calculations that we will realize require an enormous idealization, since we considered a model of the Universe where the galaxies are distributed homogeneously. We will not consider its groupings in cluster or super cluster. We will consider in addition, that each galaxy has a spherical symmetry with a similar diameter, and that each one contains 7×10^{11} stars (similar to our Milky Way galaxy), all of them with similar dimensions to the sun, and its same mass. The spectral radiation of the stars will be considered according with characteristics of each kind of star: its temperatures, mass, and percentage of distribution in the Universe according with the Harvard Spectral Classification (HSC).

With all these considerations, in spite of an extreme idealization, we think that we can obtain a good approach that helps to prove our hypothesis, since it really fulfills these characteristics to large scale of the universe, where we will make our calculation.

The photons of each of these stars travel freely by the space until us, only if these don't collide with some galaxy in its route and are absorbed by some star or the interstellar material. This trajectory is well-known like mean free path in the kinetic theory of ideal gases. As in that case, we consider the photons like particles that travel through obstacles: static galaxies uniformly distributed in the universe, and its trajectory is known like bottom limit [24]. This quantity can be calculated with the following expression,

$$\text{bottom-lim} = \frac{\text{Vol-occupied-for-galaxy}}{\text{Area-transversd-section}} \quad (24)$$

This limit can be calculated in approximate form since we know the average density of matter in our universe, and with this we can calculate the average volume that occupies each galaxy in the universe. The average density of the Universe can be defined as the volume of space that each galaxy with an average mass can occupy when their galaxies are distributed uniformly in the space

$$\rho_0 = M_{gal} / V_{ocup} , \quad (25)$$

then, replacing the density since $\rho = 1.67 \times 10^{-27} \text{ kg} / \text{m}^3$, and the mass of a average galaxy is 7×10^{41} times the mass of our sun: $1.393 \times 10^{42} \text{ kg}$; therefore

$$1.67 \times 10^{-27} = 1.393 \times 10^{42} / V_{ocup} \quad (26)$$

and solving this equation we obtain $V_{ocup} = 8.341 \times 10^{68} \text{ m}^3$.

We don't know the average cross-sectional area of the galaxies, but we know that most galaxies have of 1 until 100 *kpc* in diameter [25]. Then we could consider a minimum diameter for this analysis, and to take for our galaxy with spherical symmetry, with a diameter equal to 1 *kpc*. With this we obtain the cross-sectional area equal to $7 \times 10^{38} \text{ m}^2$. Therefore already we can to obtain the bottom limit: $l = 1.1916 \times 10^{30} \text{ m}$. This value indicates the distance limit to which each star of a given galaxy can reach with its light to another galaxy, i. e., this magnitude indicates the distance which a given galaxy, is covered by all the other galaxies. This means that if you have a very powerful telescope to reach this limit, and you could focus in any direction, always you would find a star, and therefore it would prevent to a ray of light of any other star out of this distance to cross this limit. The trajectory of this ray of light has been called by the old astronomers like sighted line [24]. The average decay of photons that are absorbed by other stars in their travel from a distance r is given by $\exp(-r/l)$ [24].

All the radiation of the universe, or at least that reaches to arrive until us until the bottom limit, can be calculated at average, dividing the space in infinitesimal spherical layers, taking like origin any center of a MGRC.

The radiation intensity or number of photons will depend directly on the number of stars contained in each infinitesimal layer, whose volume can be expressed like

$$4\pi r^2 dr . \quad (27)$$

The number of galaxies contained in each infinitesimal volume is calculated dividing this with respect to the average volume that occupies each galaxy in the universe

$$\frac{4\pi r^2 dr}{1.1916 \times 10^{68}} . \quad (28)$$

This quantity will give us the average number of galaxies contained in each infinitesimal layer like a quadratic function of its distance to a MGRC. But also we know that each

galaxy contains 7×10^{11} stars, therefore the total number of stars for each layer will be obtained multiplying the previous expression by this number

$$\frac{7 \times 10^{11}}{8.341 \times 10^{68}} 4\pi r^2 dr. \quad (29)$$

Each star emits a solar spectral radiation, and whose expression for the number of photons by unit of area, unit of frequency and unit of time is

$$\frac{2\nu^2}{c^2} \frac{1}{e^{h\nu/kT} - 1} \quad (30)$$

where k is the Boltzmann's constant, c is the speed of light. This function is due to multiply by the superficial area of the star (in our model with similar dimension to our sun), that is $6 \times 10^{18} m^2$, for to obtain the total number of photons that emits each star every second for each frequency of its spectrum

$$\frac{2\nu^2}{c^2} \frac{6 \times 10^{18}}{e^{h\nu/kT} - 1} \quad (31)$$

Now, this amount is due to multiply by the total number of stars that there are in each shell, calculated previously in the eq. (29), for to obtain a spectral radiation of photons in function of the distance r

$$\frac{2\nu^2}{c^2} \frac{6 \times 10^{18}}{e^{h\nu/kT} - 1} \frac{1}{1.1916 \times 10^{57}} 4\pi r^2 dr, \quad (32)$$

but as the radiation of each star in each layer emit of a r distance from our MGRC, its light is dispersed on a spherical surface area with this radius, and then it's necessary to divide the previous expression by $4\pi r^2$

$$\frac{2\nu^2}{c^2} \frac{6 \times 10^{18}}{(e^{h\nu/kT} - 1)} \frac{1}{1.1916 \times 10^{57}} dr, \quad (33)$$

and this effect is compensated by the volume of each layer, therefore its contribution will be a constant quantity for each shell independently of the distant r .

Also, the quantity of photons that arrives from the space until us is reduced in quantity by the absorption of all the stellar objects like we explain before. This average diminution is exponential, and we have

$$dN(r, \nu) = \frac{2\nu^2}{c^2} \frac{6}{(e^{h\nu/kT} - 1)} \frac{1}{1.1916 \times 10^{39}} e^{-r/l} dr \quad (34)$$

Besides, the radiation intensity that is received from each layer to r distance is obtained multiplying the previous expression by the energy of each photon corresponding to its

frequency, where the energy of each photon are modified in its route by the gravitational redshift, in agreement with the equation (22)

$$dI(r, \nu) = dN(r, \nu) h \nu', \quad (35)$$

Then the spectral radiation for each shell is due to write like

$$dI(r, \nu') = \frac{2\nu'^2}{c^2} \frac{6}{(e^{h\nu'/kT} - 1)} \frac{h\nu'}{1.1916 \times 10^{39}} e^{-r/l} dr \quad \text{with} \quad \nu = \left(1 + \frac{4\pi R \rho_0 G}{3c^2} r\right) \nu'. \quad (36)$$

We have decided to write the expression of ν in separated form by the complexity of this function.

For any distance r we receive a spectral radiation of the stars in the Universe at this distance that we can express like

$$\sigma(r, \nu') = \frac{2\nu'^2}{c^2} \frac{6}{(e^{h\nu'/kT} - 1)} \frac{h\nu'}{1.1916 \times 10^{39}} e^{-r/l} \quad \text{with} \quad \nu = \left(1 + \frac{4\pi R \rho_0 G}{3c^2} r\right) \nu'. \quad (37)$$

This is an energy density of a spectral radiation density that arrives until us with a redshift in linear function of r , like it's showed in the expression for ν , Eq. (22). We suppose that this radiation that arrives to us, ν' , is the spectral radiation of the CBR.

Now, we are interested in to obtain a graphic of the energy density in function only of r . We can rewrite this equation (37) like:

$$\sigma(r, \nu') = 7.41 \times 10^{-89} \frac{(1 + \alpha r)^2 \nu'^3}{(e^{\beta(1 + \alpha r)\nu'} - 1)} e^{-\lambda r} \quad (37b)$$

where $\alpha = \frac{4\pi R \rho_0 G}{3c^2}$, $\beta = h/kT$ and $\lambda = 1/l$. Now, all this parameters can be calculated,

and also it is necessary that r could be scaled because the values of α and β have not to be very small because the calculations in a computer have an insufficient exactitude. We can express this function with the distance r in an order scale of 10^5 megaparsec writing $r = 3.028 \times 10^{27} r'$ (expressing the distance r in meters). Considering that the temperature of a star kind G like our sun, and then substituting the constants values and r we obtain the numerical values for $\alpha = 25.59$, $\beta = 8.42 \times 10^{-15}$ and $\lambda = 0.002584$.

We will fix ν' in a value where the frequency is maximum of the intensity of CBR: $\nu' = 1.5 \times 10^{11}$; substituting these values in eq. (37b) we finally have

$$\sigma(r) = 2.5 \times 10^{-55} \frac{(1 + \alpha r)^2}{(e^{\delta(1 + \alpha r)} - 1)} e^{-\lambda r}$$

where $\delta = \beta \nu' = 1.26 \times 10^3$. With this consideration the function only depends of the r variable, and now we can obtain its graphic in function of this, that show all possible values of ν that contributes (for all the stars at any distant r) with some fixed ν' (see figure 3). Although here we consider a star like our sun, the density energy distribution is similar with any other kind of star of HSC.

We can observe in this graphic that the maximum in its intensity corresponds approximately with a similar distance to the bottom limit. Also this maximum coincides approximately with the frequency of the maximum of the spectral solar radiation (3.5×10^{14} Hz). Therefore its redshift ($\Delta\nu = 1,570$ Hz) for this distance is approximately similar to the quantity needed for to obtain the radiation with the frequency of the CBR. We consider that this region represents the limit of the visible Universe because its frequency with an extreme redshift is outside of the zone of the visible spectrum (we suppose that is from here that the radiation arrives to us as the CBR). Therefore, we have to calculate the CBR from this limit until infinite; here we will consider the infinite like the distance where the contribution of the radiation is annulled by the negative exponential of the bottom limit, and for a numerical calculation this approximation is valid. Similarly how we do with the energy density, we fix a numerical ν' value, and integrate this expression. We calculate it doing this for different values of ν' , varying from 1×10^9 Hz until 1×10^{21} Hz. With this we are adding the contribution for ν' , from any ν of the spectrum of all stars, and at some specific distance out of the visible Universe.

We have to take in consideration that each shell contributes with different quantity of photons ν' to the CBR spectral for the same frequency ν , because their gravitational redshift is function of the distance. Near to the bottom limit is where its intensity (or number of photons) contribution is maximum because here is where the radiation coincides with the maximum intensity of the solar spectral radiation. Outside of here, their frequencies are out of the maximum of the CBR and its contribution is minor. But this minimum limit depends also of the frequency of the maximum spectral radiation for each kind star of the HSC, because for to reach the frequency ν' depends of the distance traveled for its light. So we have that for to integrate numerically the contribution of each kind of star in the equation (37b), from near of minimum limit, for each kind of star, $r_i = 3 \times 10^{28}$ m (M), $r_i = 4.5 \times 10^{28}$ m (K), $r_i = 6 \times 10^{28}$ m (G), $r_i = 7.5 \times 10^{28}$ m (F), $r_i = 1.2 \times 10^{29}$ m (A), $r_i = 1.2 \times 10^{29}$ m (B), until $r_i = 6 \times 10^{30}$ m, doing a numerical calculation, and considering that $dr = 3.028 \times 10^{27} dr'$:

$$I(\nu') = 2.22 \times 10^{-61} \int_{r_i}^{r_j} \frac{(1 + \alpha r)^2 \nu'^3}{(e^{\beta(1+\alpha r)\nu'} - 1)} e^{-\lambda r} dr. \quad (38)$$

For radius minor that r_i its contribution is not considered because this radiation is perceived like the spectrum of each star with a specific location and not a back-ground radiation. Calculating the contribution for each kind of star we have to multiply each this with the percentage factor of its distribution (0.76 (M), 0.12 (K), 0.076 (G), 0.03 (F), 0.006 (A), 0.0013(B)), and its respective average mass: ($0.45M_\odot$ (M), $0.6M_\odot$ (K), M_\odot (G), $1.2M_\odot$ (F), $1.75M_\odot$ (A), $9M_\odot$ (B)). But we are not considering the star of kind O because its fraction is very small and its frequency is far of the bottom limit, therefore its contribution is negligible. Finally we adding each contribution and we obtain a graphic that is showed in the Fig. 4.

Also, we can calculate the average temperature for this spectral radiation intensity by mean of the Stephan-Boltzman law for the radiation [26],

$$\rho \cdot c^2 = \frac{4\sigma}{c} T^4 \quad (39)$$

where ρ is density of the radiation in the universe; this represent, in average, 0.01% of all matter from our universe as we explain before: $1.67 \times 10^{-31} \text{ kg/m}^3$; c is the speed of light: $3 \times 10^8 \text{ m/s}$; σ is the Stephan-Boltzmann constant: $5.67 \times 10^{-8} \text{ Jm}^{-2}\text{K}^4\text{s}^{-1}$. Finally, with all these data we found that this temperature is 2.11 K , very approximated to 2.73 K of the CBR obtained from observational measurements.

C) Curvature of the Hubble Diagram

Because we don't believe in the expansion of the Universe, also we have to explain the curvature of the redshift obtained with the measuring of the luminosity of the distant Supernovas [23], and that had been interpreted how the Universe is accelerating (or decelerating?). In this section we use the exact expression of the generalized Hubble's law (eq. 12):

$$cz = \frac{GM}{cR} \ln \frac{r}{R}$$

because to near distance of the periphery of R is valid. Out of this limit, we have to use a linear approximation because, as we explain before, to a greater scale the Universe is homogeneous and isotropic, and therefore the effect have the same in any direction or length. With the function we could to obtain its graphic like is showed in Fig. 5. Here we can to observe that our model adjust relative well, because its curve falls between the error bar, according with [27].

4. DISCUSSION

We demonstrated that the redshift of light could be explained like a gravitational effect of restrain, which depends on the form of the gravitational potential caused by the distribution of matter in the Universe. Our analysis consisted first of proposing, at hypothesis level according to deductions based on observational data and physical considerations, that the structure of the Universe has a distribution of matter inversely proportional with the square of the distance to the gravitational center (MGRC), in dynamic balance with infinity of them with a similar distribution.

We think that, at scale of cluster or super cluster, is the maximum unit of the Universe in which the matter is grouped, how they were the bricks of the universe. The interaction between these units is by means of translational force, where they are in dynamic balance since does not exist a gravitational center that dominate, or that is the center of rotation of the others MGRC. Its structure could be a like fractal with a variance in scale of its matter distribution in function of the distance inversely proportional of some potential, with a radius limit R , where the Universe goes towards an average homogenous (when the potential goes to second order), in spite of its apparent random distribution in smaller scale.

Making a "stellar dynamics" analysis for a smoothed distribution of matter we obtain the calculation of its average gravity to the R scale. We made an analysis with the Equivalence Principle, using the Energy Conservation Principle and Einstein Mass-Energy relation, and with these we obtained its gravitational redshift z . From here, we obtain from first principles, a mathematical expression for the H constant, and a generalization of the

Hubble's law. With this last, we could to explain the curvature of the Hubble diagram, without the need of the hypothesis of the acceleration of the Universe[28, 29], according to the BBT.

With the value of H , obtained of the linear approximation of the curvature of the Hubble diagram (obtained by astronomical observations to the scale of Giga-parsecs), and the known mass density of the Universe, we calculate the numerical value of R . The value obtained corresponds approximately with the distance or scale where the Universe transit to the homogeneity. Also, with this value of R introduced in the eq. (17) we obtained the approximated deceleration of the Pioneer anomaly. Finally, with all these calculations, we arrive to a linear expression in function of the distance r , for the calculation of the gravitational redshift of the light.

We also calculate the distribution of the radiation of all stars in a limitless universe. The model that we presented here is highly idealized, for obtaining a simplified calculation: since we consider that the stars are similar to the sun, and also that they are grouped in galaxies with spherical symmetry, similar diameter and a uniform distribution by all the space. Our simplified model doesn't consider the groupings in cluster of galaxies, or supercluster. Also we considered that the radiation that arrives until us from the entire Universe is with a constant intensity in all time and place, which implies an infinite, eternal and self-sustainable universe. We also proposed that this radiation, besides undergoing a gravitational redshift, it crosses a mean free path, reaching a bottom limit. Considering all these, we did a calculation of the total average radiation in any part of the Universe and at any time. Our results obtained showed a radiation distribution in the range of frequencies and intensity similar to the CBR. Besides, we calculate with the Stephan-Boltzmann law for radiation the average temperature of the universe. Our calculation is minor only to 0.6 K than that obtained with observational measurement. It's a very good result, considering that we don't know all data with exactitude. It's another indication that the CBR could be due to the radiation emitted by all stars of an infinite Universe. This exactitude was not obtained with the BBT, where the last value predicted before the discovering of the CBR was approximately to 50 K [9].

Our result, in addition, solves the Cheseaux-Olbers paradox (here we are including the name of Cheseaux for historical justice, see [24]), since it allows to show that the infinite Universe is not flooded with radiation by the barrier that the bottom limit represents: because it prevents that the photons from the infinite Universe arrives until us. Also the diminution in the intensity is caused by the reduction in energy of these photons by the extreme gravitational redshift. Paradoxically, the CBR could be the radiation predicted by them.

In agreement with our hypothesis, the CBR must have information of the structure of the universe. Therefore, in the future we will make a computational calculate with the details on all scale of the structure of the Universe that we propose (considering also its randomness), besides of the gravitational redshift effect. If our hypothesis is correct, we must be able to calculate their anisotropy. This could be a form to refute our model of the universe.

Our calculations have been highly idealized, but this has allowed us make approaches that have facilitated our calculations. One first approach was that actually we don't know the average radius of the galaxies and we took a minimum radius. We consider that this assumption give an error of one order of magnitude because the range of its diameter goes from 1 until 100 kpc [25]. In spite of all this, we consider that the results obtained are very good approach. We thought that this could be due because our model of the Universe could be correct, and although we do not consider the randomness of its matter distribution, to great scale this reaches a average value in agreement with the distribution that we propose, and that is observed to great scale in the Universe. In fact we have only

approximated data, as it is the case of the density of the universe, or the average radius of galaxies, that difficult to obtain a conclusive result. But we considered that if our analysis had no validity, then astronomical amounts that we have handled had to lead us to an absurd result. Nevertheless our result is approximated to two orders of magnitude of the intensity of the CBR, and its frequency is almost the same.

On the other hand, besides of the CBR and redshift, another of the supposed great evidences for sustain the BBT is the asymptotic diminution to zero of the abundance of heavy elements conform are observed in the stellar objects older, and the tendency to a constant value of 24% of the total mass in abundance of He [30, 31]. This also can be explained, according to our model, like part of the self-sustainability of the universe: most of the stars of the galaxies are of type of the Asymptotic Giant Branch whose evolution goes to the Red Giant star. These stars, during its final stage ejected its outer layers known like planetary nebula, and its core evolves to a Dwarf White. This material is expelled to the interstellar medium and it is compound of heavy elements, but also by a high percentage of H and He. We suppose that its proportion is similar like that the stars have in their photosphere (75% H, 25% He). It doesn't undergo a significant modification in its proportion during its evolution, because the nuclear reactions of stars are realized in its core and its layer which surround this. Therefore this material is recycled for the formation of new stars that appear with these heavy elements in their structure.

Now, according to the BBT, the older stars, formed first after the big bang they don't have to contain any heavy elements (Population III stars), because in the origin of the Universe this class of elements did not exist. Until now don't exist direct evidences of their existence, and some researchers thinks that they have found this in a gravitational lensed galaxy [32]. In the subsequent evolution of the stars is supposed that these became stars more metal-enriched, because they received these of the planetary nebula by previous generations and was recycled for the formation of the new stars (Population II stars). Thus the stars evolved until the present time where we have stars with high metallic content (Population I stars). But it has been possible to observe the stars with low quantity of heavy elements in the spiral arm, and great amount in the bulb and in the galactic halo of the Milky Way galaxy. This gradient in metallicity has been explained as if it was caused by the greater star concentration in galactic center and therefore greater amount of heavy elements return to new generation of stars. Nevertheless this argument is not credible because in this place the births of stars are proportionally greater than in other parts of the galaxy. Besides, observations from the Chandra X-ray Observatory confirm the theory that the super massive black hole in the center of Milky Way galaxy can help to form stars [33]. Also Yair Krongold et al have found that hot winds from this giant black hole may blow heavy elements [34]. Therefore we think that this argument neither sustains the BBT.

Another supposed test for the BBT is the phenomenon known as time dilation in supernova light curve [35,36], but this effect also can be explained perfectly with our model by the effect that gravity exerts on the dilation of time, in agreement with the equivalence principle.

In conclusion, we presented in this paper an alternative explanation for the redshift and the CBR, like a third alternative to the two already know: the BBT and SST; postulating in consequence a new structure and dynamic of a Static Universe: infinite, eternal and self-sustainable. We consider that our model is more simple and coherent than them, and falsifiable in the Popperian sense of the term.

We know that our model is a gross approximation, but our initial intention is to follow the John Wheeler's First Moral Principle: *Never does a calculation until you already know the answer*. Therefore we do first a semi quantitative analysis (physical analysis of the order of

magnitude), and then in the future, we will do a better mathematical and computational analysis. But also we need for a better model, more accurate observational data. Therefore we must be more aware about the limiting, humans and technical, but also epistemological, as was shown in the Chaos theory. We must be cautious about theories that present models with a great approach, because with the math and enough quantity of parameters, any curve can be adjust. As Einstein said: *our model must have the smallest possible number of arbitrary parameters*. This is the problem in the Science in the actuality, how was expressed by Abraham Moles[37]: *we live in the era of Quantofreny* (obsession with the precision of measured quantities), in the belief that our models can achieve any precision.

We don't consider that our work is a better explanation about the Universe with respect to the others models, but it tries to show that exist another possible explanation about the Universe. We conclude that with respect to anything, but especially with regard to the Universe, are difficult to have absolute certainty. Therefore, we have opened the range of all possible explanations.

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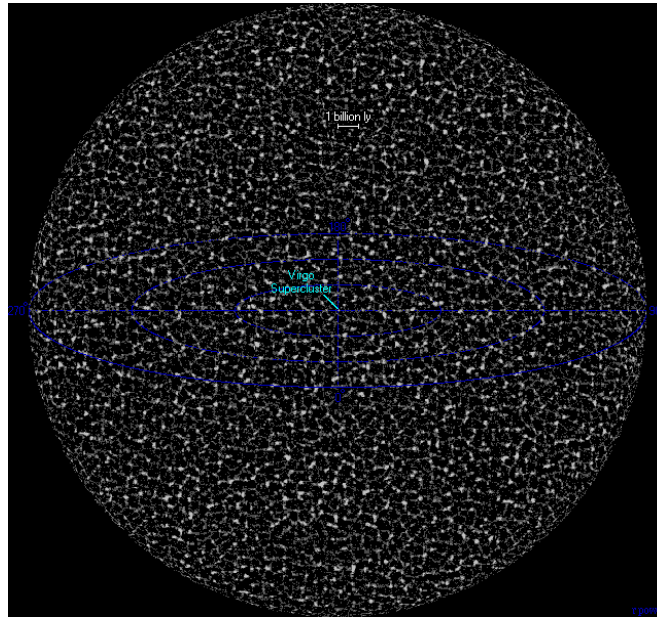


Figure 1. Atlas of the visible Universe (14 billions light years of the sun). To this scale the Universe is fairly uniform (Atlas of the Universe, from Richard Powell).

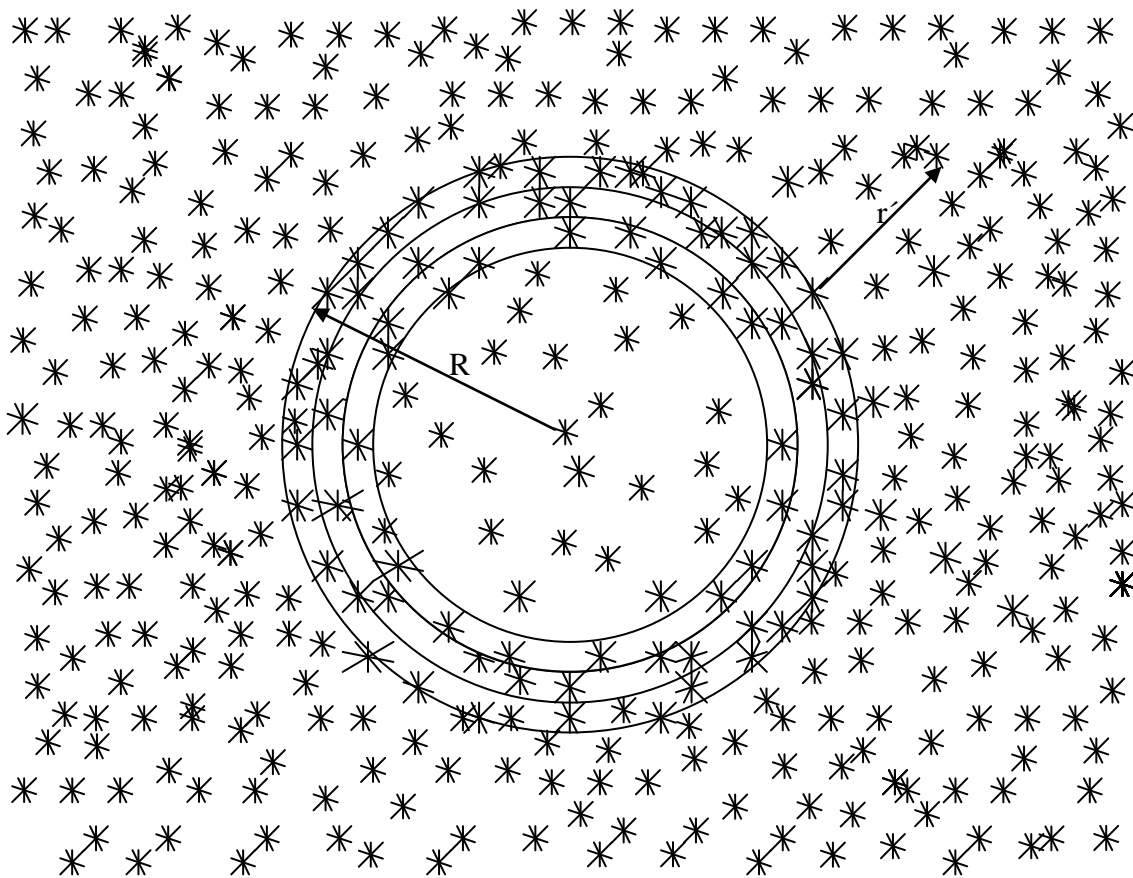


Figure 2. Schematic diagram showing how the galaxies are distributed in the Universe until to reach a homogeneous distribution to the distance R from our galaxy.

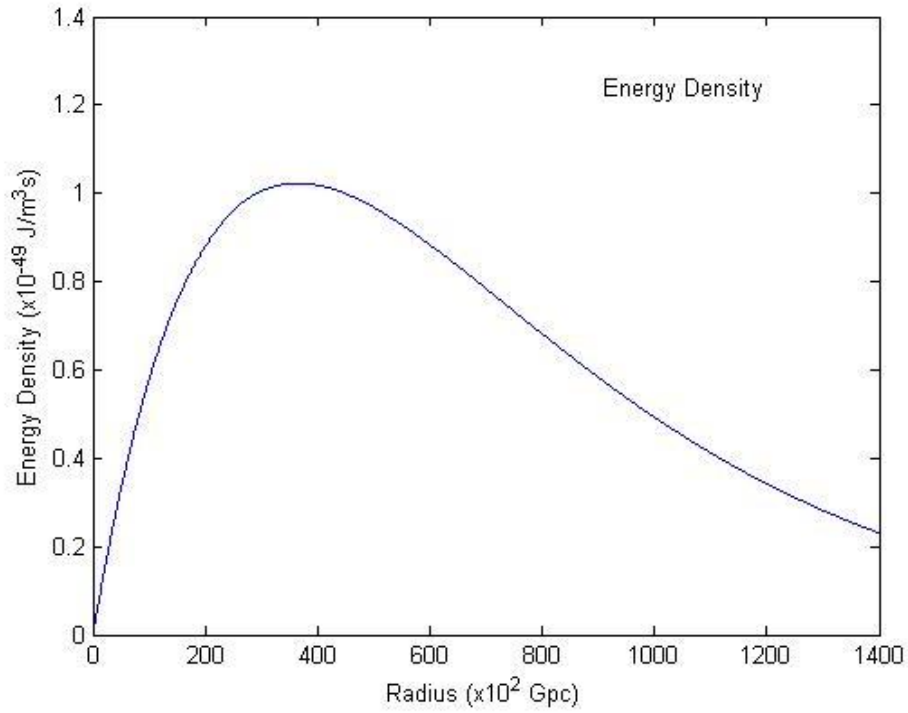


Figure 3. Spectral radiation density of the Universe in function of the r distance from the MGRC (Maximum Gravitational Rotation Center), calculated according to our model.

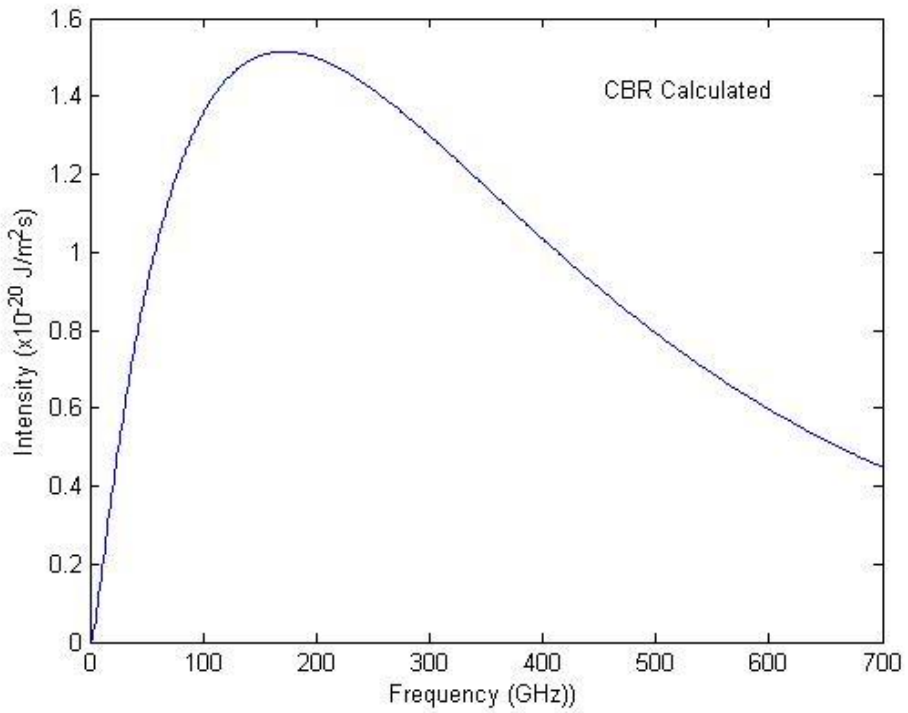


Figure 4. Spectral radiation intensity of the Universe, calculated according to our model and that approximates to the CBR obtained from astronomical measurements.

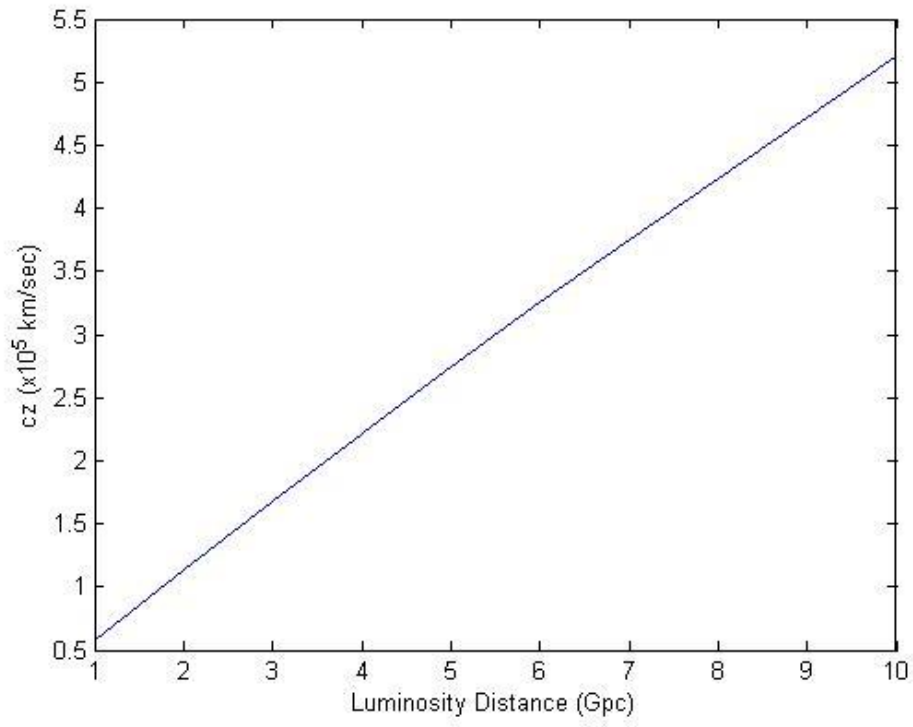


Figure 5. Redshift of the distant Supernovas vs. luminosity distance.