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Cosmological Model of Living Universe. Quantum Origin of Universe

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Introduction

The universe model described in this article leans on a semi classical quantum postulate like the Bohr postulate for the atom, on certain considerations about the behavior of the energy in the black hole's environment and on a hypothesis about the space-time structure.

In the first two epigraphs, it is developed the postulate and the hypothesis, in the following ones it is shown how this model completes the gravitational tests (precession of the perihelion of Mercury and deviation of the light rays for gravitational fields). To conclude, it is discovered how this model can describe some of the current cosmology mysteries based on the General Theory of Relativity (GTR).

Definitions and Quantum Postulate of Gravity

In the following epigraphs, it is used some concepts that are defined next. Likewise, in what follows m0 it will indicate rest mass and m relativity mass.

Planck Constant, from now on h. (ħ will be h/2π).

Planck mass, from now on mp, is the obtained mass value combining the constant G, c and ħ appropriately as $(\hbar\ c\ /\ G)^{1/2}$.

Planck length, from now on $l_p = (\hbar\ G\ /\ c^3)^{1/2}$, is the Compton wavelength of the Planck mass particle.

Planck time, from now on $t_p = (\hbar\ G\ /\ c^5)^{1/2}$, is the time that takes the light in traveling the Planck length.

Event horizon of an observers with rest mass m_0: $H_s = 2G\ m0\ /\ c^2$ o $H_s = 2G\ h\ /\ c^3\ \lambda_c$ where λ_c is the observer Compton wavelength.

A black hole is, by definition, the geometric place in which the escape speed of a gravitational field becomes same or bigger that c (speed of light), concretely, if a spherical and homogeneous distribution of mass M is considered, it would be a radio sphere $r = 2GM/c^2$. It will be considered black holes without charge neither angular momentum.

Postulate

A particle of mass m regarding a black hole of mass M should have a minimum angular momentum of ½ ħ (m v r = ½ n h / 2π, n>0). In consequence, a minimum speed exists, v, intrinsic and normal to the axis that unites them. The gravitational force resultant will be $F = -\ GMm/r^2 + mv^2/r$. In addition, we can consider the gravitational field resultant as

$$V = -GMm/r + n^2\ \hbar^2/(8\ m\ r^2) \quad (2.1)$$

$$V = -GMm/r + m\ c^2\ n^2\ \lambda^2/(8\ r^2),\ \text{where}\ \lambda = \hbar\ /\ m\ c \quad (2.1)$$

In the previous paragraph, it has been postulated that the particles trajectories in the gravitational field of a black hole are orbits around the center of the gravitational field in each point with a quantized angular momentum L = 1/2 n ħ. This postulate is like the one enunciated for the atom by Bohr.

Now we can study as "it grows" a black hole characterized by the radius $r = 2GM/c^2$. When growing, by definition, a black hole cannot lose its identity of black hole. Which will the minimum energy quantity be that it can absorb without losing that characteristic and in what minimum time can it take place? Since this energy will be a black hole's characteristic, it will be the same one every time.

Let us consider the new radius, $r_1 = 2G\ (M + m)/c^2$, consequence of the m absorption and let us calculate the difference with the previous radius, r_0

$$r_1 - r_0 = 2G\ (M + m)/c^2 - 2GM/\ c^2$$

$$r_1 - r_0 = 2Gm/\ c^2$$

On the other hand, this energy increment should complete the uncertainty principle

$mc^2\ \Delta t >= \hbar/2$ and $\Delta t\ (\text{minimum}) = \hbar/\ 2\ mc^2$

If we consider that c is the limit for the expansion speed of the black hole, we obtain that $c = r_1 - r_0\ /\ \Delta t$ (for the minimum time) and consequently $m^2 = c\hbar/4G$. Of this expression yes one can calculate the value of m that coincides with the value of half Planck mass, $m = (c\hbar/G)^{1/2}\ /\ 2$, $r_1 - r_0 = l_p$ and $\Delta t = t_p$. Therefore, we can consider that a black hole grows absorbing energy quantum for value of half Planck mass. During any time, the black hole will accumulate energy on the exterior of its event horizon until accumulating to the quantity of half Planck mass, growing at this time a Planck length at one Planck time. The black hole mass value would be N mp/2; N is a number that indicates the order of the last process of absorption and the black hole radius will be N lp.

In the previous paragraph it has been considered to c as maximum expansion speed limit of a black hole, implicitly it has also been considered that it is the minimum expansion speed limit in each process of absorption. This limit is justified when also considering to the event horizon subject to the escape speed condition of a black hole like c.

We see that the form of growing a black hole is with energy quantum of value ½ mp c2 each Planck time. The black hole density you can calculate easily

Density = N m_p / (8/3) $\pi N^3 l_p{}^3$ or $3c^5/ 8\pi N^2 hG^2$g/cc (2.2)

If we keep in mind that N l_p is the black hole radius, R, do we find that the black hole density comes given by the expression $\rho=3c^2/8\pi GR^2$ a black hole always has critical energy density.

We can also calculate the following spherical cap density that will be absorbed by the black hole

Superficial density = m_p / $(8\pi N^2 l_p{}^2)$ lpg/cc or m_p / $(8\pi N^2 l_p{}^3)$g /cc (2.3)

In addition, the potential energy of the particles that enters in the black hole. If in the expression that appears in (2.1), $m c^2 n^2 \lambda^2/(8 r^2)$, we substitute m for ½ m_p, we obtain

$V = - G m_p m_p / 4l_p + 1/4 m_p c^2 = 0$ since $G m_p / l_p = c^2$ (2.4)

All the particles enter with the same zero potential energy. If we introduce an integration constant with value $-1/2 m_p c^2$ (choosing the zero level for the gravitational potential in an appropriate way) and since all the particles enter with relativity energy $1/2 m_p c^2$, we could affirm that all enter with zero total mechanical energy.

A black hole, therefore, is much defined with a whole number N.

Hypothesis

The time and the space are symmetrical three-dimensional subspaces and together they form the space-time of the events. The symmetry plane would be in the event horizon of a black hole. That is to say, the event horizon of a black hole would separate to two symmetrical universes; the space dimensions of the universe mother would constitute the temporary dimensions of the universe son. Our universe would be a black hole inside another external universe. The space dimensions are generated in the beginning of the new universe as of three microscopic dimensions of the universe mother (rolled dimensions). The three temporary dimensions of the universe mother could give place to three microscopic dimensions in the environment of the elementary particles (rolled dimensions) of the universe son. The group of a universe mother and another son could be described with nine dimensions. These dimensions would group of three in three alternating their functionality in each generation.

The movement state of all the particles inside the new universe would share a cosmological component (radial) with speed value c (about the coordinated time t_3) that could denominate cosmological time, synchronized to all the particles, the coordinated t_1 could denominate it gravitational time and the t_2, electromagnetic time (both polar and orthogonal coordinates). The time and the space for each particle would be isomorphic and their movement state would come given by an expression just as the following one

$$(dx, dy, dz) = \begin{vmatrix} v_{x1} & v_{x2} & c \\ v_{y1} & v_{y2} & c \\ v_{z1} & v_{z2} & c \end{vmatrix} * \begin{vmatrix} dt_1 \\ dt_2 \\ dt_3 \end{vmatrix} \quad (3.1)$$

The essence of this hypothesis is the proposal that the time is a three-dimensional subspace. The events of our universe will be developed in some of their three temporary coordinates, cause-effect environments or temporary parameters of the wave functions. Each events environment will be independent. Although we can observe them to the unison on the spatial coordinate's subspace, the binding cause-effect principle to each temporary coordinate will be applied to each environment for separate. In each environment of causation, the cause-effect principle is preserved simulating the rest of environments to be geometric properties of the first space-time of four dimensions.

The predominant interaction in our daily life is the electromagnetic one. The life of each one of our cells is measured by this temporary coordinate (t_2). The Special theory of Relativity, based on the Maxwell electromagnetism, refers only to her. The gravitational events however would be developed on another coordinate (t1) formally similar. Keeping in mind the gravitational time, would be possible to describe the gravitational field from a similar way to the electromagnetic field. The sources and drains would be the particles of the universe mother and of the son. The gravitational force takes this way, initially, the sense of force of repulsion among same charges in the universe son (the virtual gravitons would navigate with negative t_1). The interaction between our universe and the external universe has as carrier the Planck mass, we could identify it with the unified field, and it would be like the C field postulated by Fred Hoyle [1].

This interaction would be the responsible for the collapse of the wave function that describes the universe entirety.

It is interesting to make notice here that this hypothesis solves the propagation speed problem of the gravitational interaction. Indeed, about the time t_1 the gravitons move to the speed of light, however, this interaction observed from the time t_2 seems instantaneous because t_1 and t_2 are orthogonal coordinates.

It means this that each Planck's time the universe would expand a Planck length and it would receive half Planck mass. The expansion speed would be c = 2,998 10^{10} cm/sg. This expansion would not be consequence of an explosion, but characteristic of the space-time structure generated by the events universes. It would be consequence of an interaction between a universe and another and it would be controlled by the Planck constant that would take the sense of engagement or continuity constant. The external universe can go accumulating energy near the events horizon of the black hole during any quantity of time. When enough energy is accumulated (one Planck Mass), the step takes place from half Planck Mass to the black hole or universe son in a Planck Time of the universe son and the rest returns to the universe mother in a Planck Time. In this event, the uncertainty principle is completed: ½ m_p c_2 $t_p = \hbar/2$ in both universes.

Consequences of this hypothesis are to verify that the Hubble radius (R_h), the age of the universe (t_3) and the mass of the universe would be well-defined quantities (a number exists, N, that defines our universe in each instant) and that the universe has intrinsic and permanently critical energy density. The universe expansion would not be a geometric characteristic of the electromagnetic space-time of four dimensions, but rather consequence of the movement to c speed of all the particles on the coordinate temporary radial t_3. The universe expansion would be a phenomenon with own entity generated on the third component of the time, t_3, and therefore, applicable to any particle in an independent way.

This expansion would not be directly observable. Temporary references don't exist on the cosmological temporary coordinate when sharing all the observers the same t_3 value, however, yes it will generate a speed observable in the times t_1 and t_2. This speed observable is what is denominated Hubble law and in general and following a simple geometric reasoning, it can be applied to a particle as continues (R_h is the Hubble radius and r the distance to the observer)

$$v_0 = c\, r / R_h. \qquad (3.2)$$

Consequence of this hypothesis is to consider the particle speed as the composition of two derived speeds each one of them on the times t_1 and t_2

$v = v_2 + i\,|v_1|$ (i is the imaginary unit)

$$v^2 = v_2^2 + v_1^2 \qquad (3.3)$$

The speed that we observe would be the speed on the electromagnetic time; in (3.3) it has been denominated v_2. The speed on the gravitational time has denominated it v_1. If we consider the speed v indicated in (3.3) the responsible for the mechanical energy of a particle, in (3.3) it will be necessary to discount the due speed to the expansion on the time t_3 (v_0), since this doesn't contribute to this energy

$$v^2 = v_2^2 + v_1^2 – c^2 r^2 / R_h^2 \qquad (3.4)$$

If the gravitational potential energy of a particle in a gravitational field generated by a mass M identifies it with the kinetic energy on the time t_1, we can find an expression for v_1

$$v_1 = i\,(2\,G\,M / r)^{1/2}; \qquad \mathbf{v} = v_2 + i(2\,G\,M / r)^{1/2} \qquad (3.5)$$

In addition, the expression (3.4) is as

$$v^2 = v_2^2 + 2\,G\,M / r – c^2 r^2 / R_h^2 \qquad (3.6)$$

The total energy of a particle comes given by the expression $E^2 = m_0^2\, c^4 + c^2\, p^2$. If we admit that the particle momentum, p, comes given by the speed v of (3.6), we obtain the following expression for the energy

$$E^2 = m_0^2\, c^4 + c^2\, m_0^2\, (v_2^2 + v_1^2 – c^2 r^2 / R_h^2) / \gamma^2 \qquad (3.7)$$

Where γ is the conversion factor of the Lorentz transformations. In (3.7) they are included the speed as much on the time t_1 as on the time t_2; we can find as of this a widespread expression for γ. The energy of a particle you can also express as $E^2 = m_0^2\, c^4 / \gamma^2$, if we substitute this expression in (3. 7) and we make some simple operations, we obtain

$$\gamma=(1–v_2^2/c^2 – 2\,G\,M /c^2r + r^2 / R_h^2)^{1/2} \qquad (3.8)$$

The new expression, that this model contributes, unifies the Special and General theories of Relativity and it can be used to verify the execution of diverse gravitational tests, as it will be seen in the following epigraph. In addition, the Strong Equivalence Principle is deduced directly of (3.7) this model completes it strictly. If we consider a particle at rest to that with mechanical energy zero and we identify it with that in free fall in a gravitational field, we arrive as of (3.7) to the conclusion that the kinetic energy in the times t_1 and t_2 have opposed signs.

If we consider that our universe is a black hole in the nucleus of a galaxy belonging to an external universe, we can define the Schwarzschild metric as the general metric inside our universe in the following way

$$\begin{aligned} ds^2 = {} & c^2(1 - v_2^2/c^2 + r^2(1 - \rho(r)/\rho(R_h)) / R_h^2)\, dt^2 \\ & - (1- v_2^2/c^2 + r^2(1 - \rho(r)/\rho(R_h)) / R_h^2)^{-1} dr^2 \\ & - r^2(d\theta^2 + \sin 2\theta\, d\phi^2) \end{aligned} \qquad (3.9)$$

Gravitational Lenses

In this and in the following epigraphs, will be exposed some consequences that are deduced from this model. The treatment is simple and only it seeks to show how this model can give solution to some current Physics mysteries. A deep mathematical treatment of these ideas could open new investigation lines with surprising results. I want to indicate that in what continues, it is considered that the time and the space are later concepts to the events the time and the space are not the scenario where the events are developed, but rather they are these those that define at the time and the space when being observed.

As consequence, the deviation of the luminous rays for a gravitational field is deduced directly of (3.6), indeed, the speed of light is c, in any reference frame, the phase speed of the light is vλ = c. In absence of gravitational fields, of the expression (3.6) we obtain $c^2 = v_2^2$, being $v_2^2 = v_o c$, where v_o is the apparent speed of the light and c the phase speed, in this case the speed vo will be like c. In presence of a gravitational field (3.6) it would be $c2 = v_o c + v1^2$ and if we suppose that the gravitational field is generated by a homogeneous spherical distribution of energy with radio r and considering a universe with critical density $R_h^2\rho(R_h) = 3c^2/8\pi G$, we obtain

$$c^2 = v_o c + 2GM / r– c^2 r^2/ R_h^2 \qquad (4.1)$$

Of (4.1) it is deduced that the gravitational field will generate a refraction index dependent of r in the way

$$n(r) = c / v_o = 1 / (1 – 2GM / c^2r + r^2/ R_h^2) \qquad (4.2)$$

Expression that coincides with the equivalent one in General Relativity to exception of the cosmological term r^2/R_h^2, this term explains reason the phenomenon of gravitational lenses is so located. In absence of this term, it was of waiting the sky full of reflections and false images of distant galaxies. Applying the Fermat principle to the variable index of (4.2) we would obtain the deviation of the luminous ray: $\alpha = 4GM /c^2r$.

Precession of the Perihelion of Mercury

The planets orbits around the sun are ellipses with the sun in one of their focuses. The ellipse equation is the following one

$$r = r_0\, (1 + e) / (1 + e \cos(\phi))$$

Where r is the distance to the focus where the Sun is, r0 is the minimum distance between the planet and the star (perihelion) and e is the eccentricity. For a circular orbit, e is worth zero. The observation of the perihelion precession you can make in all the planets with eccentricity in their orbit, being but difficult their observation in those that have a small eccentricity. This movement, in most, is due to the gravitational influence of the rest of the planets, however, excess exists, more evident in Mercury that cannot be explained with Newton gravitation. This excess is the one that explains to the GTR satisfactorily. This doesn't mean that a circular orbit doesn't suffer this last movement, but rather it is indistinguishable. The precession angle predicted by the GTR comes given by the following expression

$r = r_0 (1 + e) / (1 + e \cos(\phi - \Delta\phi))$, where $\Delta\phi = 6 \pi G M / c^2 r_0 (1 + e)$

To simplify the calculation, let us consider a circular orbit (e = 0) of radius 58 10^6 Km., this is the half radius of the Mercury orbit. The orbit duration is of 88 days, and it gives 415 orbits every 100 years. M is the sun mass (2 10^{33}g.). With these data, according to the GTR, the value of the precession angle with each turn will be $\Delta\phi = 4.8235\ 10^{-7}$ rad. That multiplied by the 415.01391912 orbits per century, it is obtained 2.0018 10^{-4} rad. In seconds of arch, they would be 41.29 seconds of arch (the reality, considering the eccentricity, they are 43 seconds of arch).

The Living Universe model part of the following expression

$$\gamma = (1 - v_2^2 / c^2 - 2GM / rc^2 + r^2 / R_h^2)^{1/2} \quad (5.1)$$

In this case it is possible to calculate v_2, in effect, since the orbit is to circulate, there is fulfilled that $v_2^2 / r = GM / r^2$; the expression (5. 1) it is then

$$\gamma = (1 - 3GM / rc^2 + r^2 / R_h^2)^{1/2} \quad (5.2)$$

If we reject the cosmological term and we apply this expression to the calculation of the temporary dilation and the space contraction suffered by Mercury along the orbit, we obtain, calling t_m at the time measured in Mercury and t_t at the time measured by the observer, the following expression

$$t_m = t_t / \gamma, \qquad \Delta t = t_m - t_t = t_t/\gamma - t_t \quad (5.3)$$

The contraction suffered by the Mercury orbit will be

$$S_m = S_t \gamma, \qquad \Delta S = S_t - S_m = S_t - S_t\gamma \quad (5.4)$$

The effect of both operations is accumulative, the total effect ΔL will be

$$\Delta L = v_2 \Delta t + \Delta S \quad (5.5)$$

Since $v_2 t_t = S_t$, we obtain

$\Delta L = S (1 - \gamma^2)/ \gamma = 4{,}823538\ 10^{-7}$ rad.

This precession is the corresponding to an orbit, since Mercury gives 415 orbits every century the total precession it will be

$\Delta\phi = 2{,}0018\ 10^{-4}$ rad.

The same value predicted by the GTR.

In the previous paragraphs, it has been simplified the problem when considering circular orbits. Next, it will be attempted to generalize the problem of the particle movement in the breast of a gravitational field.

The phase speed of a particle with energy E we can define it as $w = v\lambda$, where $v = E / h\lambda = h / p$. The frequency v can also be defined as the inverse of the period, $v = 1/\tau$.

To solve the problem of finding the particle trajectory in the breast of a gravitational field, we can think, the same as in the case of the light ray deviation the gravitational lenses, that the gravitational field generates a variable refraction index n(r) defined by the quotient w_o/w. Where w_o is the phase speed in the vacuum and w the phase speed in the breast of the gravitational field.

If we keep in mind the expression given in (3.8), considering a homogeneous spherical distribution and rejecting the cosmological term, we obtain $\gamma = (1 - v_2^2/c^2 - 2GM/c^2 r)^{1/2}$. The particle wavelength will suffer a contraction being $\lambda = \lambda_o \gamma$ and the period will suffer a dilation $\tau = \tau_o / \gamma$. We arrive, therefore, to the following expression of the refraction index

$$n(r) = w_o / w;\ n(r) = v_o \lambda_o / ((\lambda_o \gamma)(\gamma / \tau_o));\ n(r) = 1 / \gamma^2 \quad (5.6)$$

The real trajectory of the particle will make of the optic path an extremal

$$n(r,\phi,\varphi) = 1 / (1 - v_2(r,\phi,\varphi)^2/c^2 - c^2 r^2 \rho(r,\phi,\varphi)/ R_h^2 + (R_h) + r^2/R_h) \quad (5.7)$$

$$\delta S = \delta \int n(r,\phi,\varphi)\, ds = 0 \quad (5.8)$$

In the case of the Mercury perihelion, as of (5.2) we obtain the following variable index

$$n(r) = 1 / (1 - 3 G M / r c^2 + r^2 / R_h^2)$$

The theoretical Mercury speed through its orbit according to Newton mechanics is of v = 4,795,831 cm/sg, this refraction index makes that the real speed of Mercury is smaller: $v_r = v / n(r)$, we find that this speed is 4,795,830 cm/sg. The difference with the previous one is of 0.36817 cm/sg; this speed along 100 years will accumulate a backwardness of 1,161,064,532 cm. that is equal to an arch of 2.0018 10^{-4} rad. The same value obtained previously.

It is easy to check that these results and those of the previous epigraph can be obtained applying the new one metric (3.9) proposal in the epigraph 3.

Naturally the exposed calculations here are very simplified, however, they allow to surmise that with this model and consequently giving validity to the expressions (3.8) and (3.9), the same results can be obtained that applying the General Theory of Relativity.

Conformal Gravity

In the two previous epigraphs we have seen as the Living Universe model is compatible with the observations and gravitational test. In this and in the following ones, we will see, how it is able to explain some other observations that the GTR is not able to predict satisfactorily.

The galaxies and heaps of galaxies suffer a rotation movement that neither the GTR neither Newton gravitation can explain. It is introduced, with object of making compatible these observations with the known gravitation laws, the concept of “dark matter”, this allows to explain the speed excess that is observed in this movements.

The hypothesis in which this model is sustained necessarily implies that our universe meets with a critical energy density, let us call $\rho(R_h)$ to this density. Let us consider the kinetic energy of a particle, without the contribution of the kinetic energy corresponding to the electromagnetic time, in a gravitational field generated by a homogeneous and spherical distribution of energy M and in free fall

$$V = -GMm/ r + ½ mc^2r^2/R_h^2 \quad (6.1)$$

This expression is easily identifiable with the one that appears in (2.1) without more than to make $r^2 = n^2\lambda^2 / 4$. This would allow extending the postulate to our universe: The objects in the universe move in orbits with quantized angular momentum $L = ½ n\hbar$ (n>0) in the breast of the gravitational field generated by the same one.

It is easy to see that with the conditions exposed in the previous paragraphs and in a universe with critical energy density $\rho(R_h) = 3c^2 / 8\pi GR_h^2$, the expression (6.1) it can be expressed in the following way

$$V = ½ H^2r^2m(1 - \rho(r) / \rho(R_h)) \quad (6.2)$$

Where H is the Hubble constant, c/R_h, and $\rho(r)$ is the generating energy density of the gravitational field. Of (6.2), applying the divergence, we obtain in this case (homogeneous spherical distribution of energy)

$$g = - ½ H^2 r \rho(r) / \rho(R_h) – r c^2/ R_h^2 + r^2 c^2/ R_h^3 \quad (6.3)$$

If we suppose that the previous distribution is a particular case and we consider (6.3) the general case, we can conclude that the form that takes a anyone of energy distribution, under their own gravitational field and due to the generated deformation by their angular momentum, it will influence in the field g resultant when depending on the expression r $\rho(r)$. For oneself density, the value of g on the exterior of a revolution ellipsoid, in its bigger semi axis, will be bigger than for the same density on the exterior of a sphere (with the same quantity of energy M). If we apply these reasoning to an elliptic galaxy applying (6.3), instead of Newton law, we obtain with enough approach the curves of radial distribution of speed that are obtained with the MOND proposal of M. Milgrom [2]. This proposal, as one knows, it described the anomalous movements of the galaxy's arms and heaps quite well. However, in this case, how we have already seen, this result is obtained with a compatible model with the General Theory of Relativity.

Redshift of Type Ia Supernova

Diverse observations made on type Ia supernovas has made suspect that the universe expands quickly. This deduction is based in that when measuring the distance by means of the observed redshift, a distance is obtained smaller than the one that should be judging by the intensity of the received light (the Ia supernovas has all the same absolute magnitude).

The redshift of the observed objects in the universe owes him, according to the classic Cosmology, to the lengthening suffered by the photon's wavelengths during its trip through the cosmos. It is usually expressed as $1 + z = \lambda_o / \lambda_e$, where λ_o is the observed wavelength and λ_e the emitted wavelength.

The expansion dynamics of the universe is expressed by means of the expansion parameter or scale factor a(t). We can define $a(t_0) = 1$, where t_0 is the present moment. The expansion parameter allows us to index the expansion in an instant t with the current expansion by means of the expression $R_h(t) = a(t) R_h0$, where R_h0 is the current Hubble radius. The evolution equation of the expansion parameter is the following

$$(da(t)/dt)^2 – (8/3) \pi G \rho(R_h) a(t)^2 = \text{constant} \quad (7.1)$$

In function of the evolution of the expansion parameter, the redshift you can express as $1 + z = a(t_o) / a(t_e)$.

The model that I propose in this article allows to calculate the parameter evolution, a(t), easily without necessity of solving the equation (7.1); indeed, in any moment, according to this model, $R_h(t) = c\, t$, in the present moment $R_{h0}(t) = c\, t_0$, of where $a(t) = c\, t / c\, t_0$

$$a(t) = H_0 t \quad (7.2)$$

Where H_0 is the current Hubble constant.

The deceleration parameter, q, can be defined as

$$q = - a(t)[d^2a(t) / dt^2] / [da(t) / dt]^2 \quad (7.3)$$

It is easy to see that in this model the deceleration parameter is worth zero permanently. If the redshift study is carried out considering a model with positive deceleration parameter, it is natural to interpret a null real parameter of deceleration, just as the Living Universe model proposes, as an accelerated expansion of the universe.

Gravitational Wavelength

The General theory of Relativity is incompatible with the Quantum Mechanics. Yet they have been fruitless the efforts to reconcile both theories. The Living Universe model proposes a path that could put an end to this situation.

In the epigraph 2, it was seen how the particle momentum it could be expressed in function of the speeds v_1 and v_2

$$p^2 = m_0^2 (v_2^2 + v_1^2 – c^2 r^2 / R_h^2) / \gamma^2 \quad (8.1)$$

A fundamental characteristic of the Quantum Mechanics is the description of the particles as waves. The wavelength of these comes determined at the kinetic momentum of the particles: $\lambda= h / m v$, where m is the relativity mass $m = m_0/ \gamma$. In the expression (8.1) we can discover a defined wavelengths composition in the times t_1 and t_2

$$1 / \lambda^2 = 1 / \lambda_2^2 + 1 / \lambda_1^2 \quad (8.2.0)$$

$$\lambda_2^2 = h^2 \gamma^2 / m_0^2 (v_2^2 – c^2 r^2 / R_h^2) \text{ and } \lambda_1^2 = h^2 \gamma^2 / m_0^2 v_1^2 \quad (8.2.1)$$

Where λ_2 can be identified with the De Broglie wavelength and λ_1 can identify it with a new gravitational wavelength that describes to all particles on the time t_1. Transferring these results to the expression of the relativity energy (3.7), we obtain

$$E^2 = h^2c^2/ \lambda_c^2 + h^2c^2/ \lambda_1^2 + h^2c^2/ \lambda_2^2 \quad (8.3)$$

This expression suggests vectorial character for the energy on the space of the times.

The De Broglie wavelength expression includes the cosmological redshift, indeed, if we keep in mind the expression (3.3) and we identify v with the speed regarding the cosmic microwaves background, we can approach this at zero at cosmological distances; the speed of our galaxy regarding this frame is of approximately 600 Km/sg. Admitting the validity of the cosmological principle, we can think that the rest of objects of the universe has a same order speed, this speed is worthless, when r becomes sufficiently big, regarding the speed $c\ r / R_h$. At cosmological distances it is also worthless the effect of the observer's gravitational field M, therefore we can put (3.3) as

$$0 = v_2^2 - c^2 r^2 / R_h^2$$

And consequently

$$v_2 = cr / R_h$$

We can identify the cosmological redshift with the Doppler effect taken place by this speed

$$\lambda_0 / \lambda e = [(c + v_2) / (c - v_2)]^{1/2} = 1 + z \qquad (8.4)$$

Substituting in this expression the previous speed obtains

$$\gamma = (1- v_2^2/c^2 + r^2 / R_h^2)^{1/2} = 1$$

$$\lambda_o / \lambda_e = \gamma / (1 - r/ R_h) = 1 / (1 - r/ R_h) \text{ and } z = r / (Rh - r) \qquad (8.5)$$

This last expression is obtained starting from the GTR, however, in this case arises from the application of the Doppler effect to a luminous source that goes away with speed v_2 about the electromagnetic time t_2.

We can wonder in view of these results: what does it mean the cosmological redshift from the point of view of the Living Universe model? Of the expressions (8.3) and (8.5) and keeping in mind the expression (3.7) we can deduce that the kinetic energy of the particle spreads at zero when r comes closer to R_h. This means that the galaxies don't really move the cosmological distances remain constant. This result is logical if we think that the expansion on the time t_3 also affects to our patterns of measures; although, indeed, an expansion, the mensuration with patterns takes place of having also measured expanded it will always give us the same distance. From this point of view, the Living Universe describes a static universe about the t_2 time.

The duality that this model contributes, when describing to the universe with a punctual and explosive origin and at the same time with a static description of the same one, it is like the inherent wave-corpuscle duality to the particle's description in Quantum Physics. This model is based on a quantum postulate, it is natural that as of him it is unavoidable a dual Universe description.

Living Universe

This model suggests that the universes would behave as alive beings: they are born, they grow, they reproduce and possibly, they die. In multitude of studies and observations are described and they attribute characteristic alive to all type of structures, entities and phenomena that at first sight would seem to belong to the inanimate thing Kingdom. James E. Lovelock discovered the vital essence of our Earth. Reason to stop in her? [3].

The universes possibly could die. This death would happen when being isolated in the universe mother. The Hawking radiation would take charge of dissolving the universe emitting a Planck particle, absorbing half Planck mass and injecting the rest in the universe mother.

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