The Matter life-cycle

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The discovery of the existence of *Multiple Nucleus Quasars* (MNQs), through the recording of high intensity gravitational waves ("forks") we have been performing for more than 10 years with our detector, has allowed us to understand what Universe *is made* of and how *it works*.

The Universe results quite different from what is today suggested to us by the Big-Bang *theory* [1]. We summarize hereunder the most important differences.

1. *No "Big-Bang" has ever taken place.* Therefore, the Universe has never had a beginning and out of some episodes of local lack of homogeneousness due to the presence of MNQs, it has always been more or less as we can see it now.

2. *The Universe is homogeneous and steady-state only on a large scale.* The MNQs, living in the centres of the galaxy clusters create local concentrations of matter. Due to general collapses "empty" areas form in the Universe, which can remain like that even for a long time.

3. *The Universe has no limits* and it is constantly and continuously expanding, on a large scale, according to the Hubble's Law. In theory, we can see as far as a distance where the speed of expansion is equal to the speed of light.

4. *The Universe keeps always young.* The collapsing mechanism of the MNQs is the way to expel the "old" matter from the Universe. Same will, then, be replaced by the "new" matter born as neutral hydrogen clouds, which are going to form new galaxies an that, later on, will fill the "empty" areas of the Universe.

5. *The cosmic microwave background (CMB) radiation is only produced in very slight quantities from the nuclear fusions reaction taking place inside the stars.* Most of it is generated by the falling down of matter on the nuclei of the MNQs.

6. *"Dark" matter does not exist.* What exists is, on the contrary, the effect produced by the *"thickening" of the ("physical") space produced by matter around it and representing its gravitational field.*

7. *"Dark" energy does not exist.* When the nuclei of the MNQs collapse the "thickened" space that they were keeping around themselves is "released" and, *while expanding, this latter allows the Universe to "widen".*

[1] See also Part 3 and 5 of **A Detector for Gravitational Waves**: *Birth and Death of Matter.*

1 Multiple Nucleus Quasars

MNQs are extra massive objects formed by a large number of nuclei (up to a few tens) tightly orbiting one around another, like the stars of a compact globular cluster. These are celestial objects living inside the galaxy clusters that take their "nutriment" from the matter forming these latter ones.

It is important to underline that, *because of the high temperature of the gas enveloping them, the internal structure of these particular quasars cannot be detected by telescopes, but only through the gravitational waves produced by the collapsing of the nuclei forming them.*

1.1 Formation of MNQs

The formation of a MNQ, starts inside the giant (elliptic) galaxies which are the oldest and most massive ones. These galaxies which have been so "lucky" during their existence not to fall into the gravitational field of a MNQ, have continued growing, fed by the matter around them (hydrogen clouds, star masses, small galaxies, etc.). Very soon a concentration of active matter forms inside them. Today, this is commonly called an *Active Galaxy Nucleus* (AGN) which gradually gets more and more massive and acquires its own identity (*common quasar*) [2].

The growth of a quasar inside it, progressively increases the attraction capabilities of the galaxy, thus speeding up its growth rate. When the quasar has become sufficiently massive, the galaxy starts being like an MNQ, even if inside it there is only one nucleus.

How is a galaxy "captured" by a MNQ? When the gravitational field of the QNM run over the galaxy, at the beginning it deprives the galaxy of those stars, planets, etc.... that are in the peripheral areas. If the "prey" galaxy is sufficiently big, it has got on its turn a nucleus at its centre. The way in which this more massive object is captured is quite different, as the gravitational field of the MNQ does not succeed in dragging it to its surface. The nucleus which can "resist" is annexed, but it keeps its own identity and in the end, it will increase by one unit the nuclei of the MNQ.

At the beginning the process for the formation of a MNQ takes quite a long time. Later on, while the nuclei gradually increase by quantity and dimensions, the growth rate is more and more accelerated. Once the matter near it is all captured, the growth rate slows down and, at that point, depends on the "new" matter that is born in the near by area. Therefore, *it is not possible to fix with a certain precision how old these celestial bodies may be, as they can live even hundreds of billion years*! We can only generally state that *the larger is the number of nuclei forming an MNQ, the older the object is.*

1.2 Collapse of a MNQ

As matter continues falling onto the nucleus of an MNQ, its mass goes on increasing, therefore the thickened space increases as well and, consequently, its gravitational field. With the increase of space density there is, on one hand, an increase of the (gravitational pressure) exerted by it on matter and ,on the other hand, an increase both of the dielectric permittivity as well as of the magnetic permeability, therefore the (local) speed of

[2]Today, astro-physicians do not accept this narrow link between NGA and (common) quasars, as they are affected by the cosmologic model of the Big-Bang and they indicate the quasars as being primeval objects of the Universe, around which matter (the galaxies) started its formation cycle.

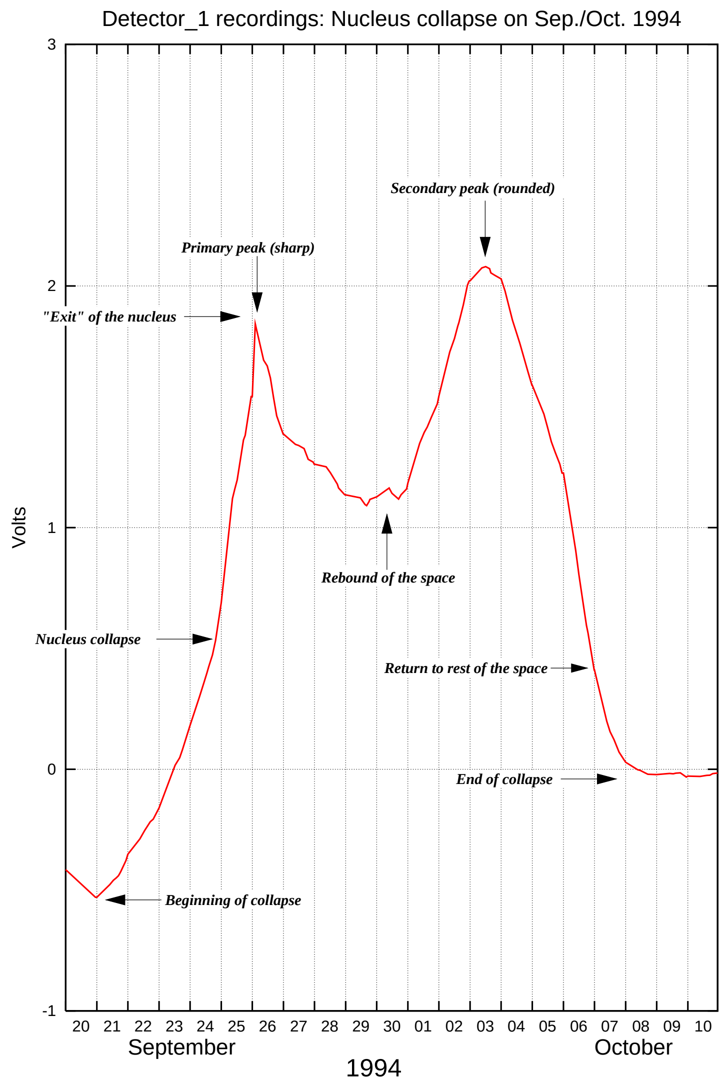

Figura 1: The collapse phases of a nucleus.

light decreases. The decrease of the speed of light, causes the (quadratic) decrease of the electromagnetic energy of matter and, consequently, of the pressure exerted by the latter on the surrounding space which counter-balances the gravitational one. A new equilibrium is reached with a contraction of the nucleus. Below given (critical) dimensions, matter is unable to "resist" gravity therefore, suddenly, there is going to be a collapse [3].

The collapsing of a nucleus produces a gravitational wave having the typical shape of a positive "fork" (see Figure 1). The collapsing phase is represented by the rising front of the "fork" and it takes place at the (local) speed of light which, gradually, increases as dimensions decrease [4]. The collapse goes on until the nucleus dimensions reach a given

[3]See also Part 6 of **A Detector for Gravitational Waves**: *The collapsing of Multiple Nucleus Quasars.*

[4]Please notice that the signal (Volts) of the detector is directly proportional to the variation of the

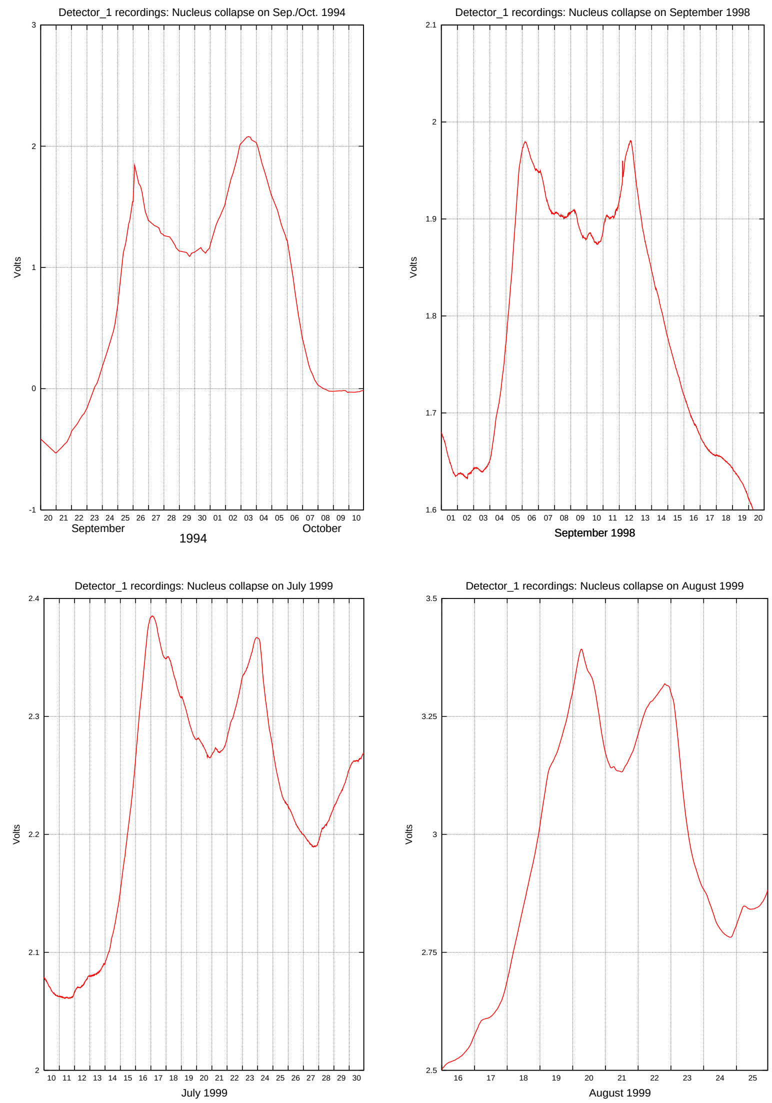

Figura 2: Samples of "fork" recorded by the detector.

value that causes the "curbing" of the space surrounding the nucleus. In this case, we say, that the nucleus has "exit" from the Universe because of *its gravitational effects are no more perceived*. Namely, the "curving" of space cuts the connection between matter and the surrounding space. The nucleus "exit" is represented by the primary (sharp) peak.

During the phase of collapse, the thickened space around the nucleus, moves towards the centre, gradually gaining speed and, therefore kinetic energy [5] Once it has reached the centre, the space rebounds on itself and produces a local contraction that is represented by the hollow of the wave which is followed by an expansion represented by the second

speed of light.

[5]The space inside the nucleus collapses and "exit" along with matter, as proved by the high intensity of the wave.

Figura 3: “Entry” and “exit”of nuclei to and from the Universe.

(rounded) peak of the wave. In **Figure 2** some specimens of the “forks” detected during these years are represented. The nucleus remains “buried” in space at the same place where “exit”. It may happen that, in the future, owing to high local gravitational disturbances, as those produced by the collapsing of other nuclei, the buried nucleus “re-emerges”, also because of the residual electromagnetic energy it still possesses, and it is even possible this one can exceed the gravitational pressure. When a nucleus “re-emerges”, a gravitational wave is produced which shape is a reversed “fork”. **Figure 3** illustrates some recordings of these events. The “re-appearing” of the nucleus is only temporary because as soon as the disturbance extinguishes the space density returns to its original value so that the nucleus disappears again.

An increase of the frequency of recordings (1 reading per minute, instead of 1 reading every 20 minutes),, which started during the first months of 2001, has allowed us to know about a detail of great importance concerning the nucleus “exit” from the Universe. The graph of **Figure 4**, illustrates a recording made in August 2001 of one of these episodes. It is really an exceptional recording, as during that period there was really no disturbance caused by the arrival of any other waves. The graph shows us for the first time how a celestial body that, as we will see later on, has got a mass of about a billion solar masses, can “disappear” like that in such a short time! The graph has allowed us to fix an upper limit to the time the nucleus has taken to “exit”. Namely, as the slope inversion of the signal lasted less than 1 minute and the redshift of the “fork” was $z = 5.5$. If we divide that time by the widening of the wave ($w = z+1 = 5.5+1 = 6.5$), we obtain a real time of less than 10 seconds.

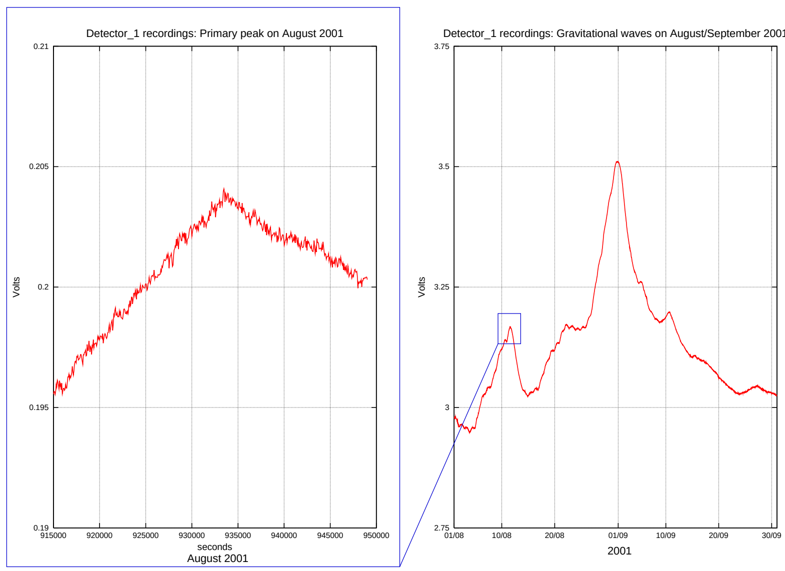

Figura 4: Primary peak recorded during the “exit” of a nucleus.

1.3 Dimensions of a MNQ

Sometimes, when a nucleus collapses same can be as a detonator to others that are near it, starting a series of chain collapses, ending in the “exit” of the most massive ones. The smallest nuclei, which are not yet in a position to collapse, are dispersed by the expandin of space and in the future, when new galaxies will be formed, these will be able to start new collapsing cycles.

The graph that can be observed in **Figure 5** shows very well the *general collapse of an MNQ* recorded between 2001 and 2003. In this case, the nucleus that collapsed first was peripheral to the MNQ, where there were another 2-3 nuclei. The gravitational wave produced by these first collapses, reached the centre of the MNQ, where there was a higher number of nuclei, thus causing a series of chain collapses whose waves in spreading later, caused the collapse of other still existing external nuclei. The waves have a redshift of $z = 8.5$ (widening corresponding to $w = 8.5 + 1 = 9.5$, so that the MNQ at the moment of collapsing was at a distance of $r_0 = 8.5/9.5\ R_U$)). As the time the first gravitational waves needed to reach the centre of the NMQ, results as corresponding to about *14 months*, if in this case too we do the correction fot the redshift we can obtain its real dimensions (radius):

$$R_{QNM} \approx \frac{14}{8.5+1} = 1.5\ light - month$$

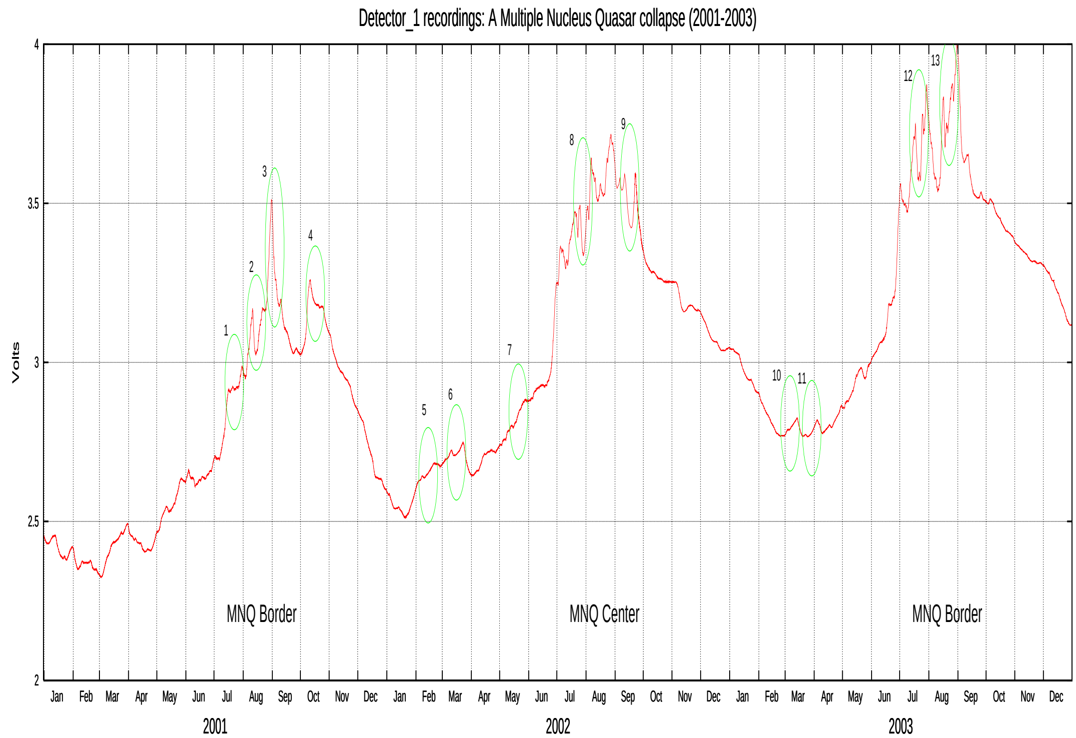

Figura 5: General collapse of a MNQ (2001-2003).

1.4 Number of collapses taking place in the Universe

Previously, on the basis of the recordings made with our *Detector N. 1*, the esteemed real number of collapses/year taking place in the visible Universe was of about fifty [6]. The starting operation of *Detector N. 3b* at the end of 2002, as this detector has proved being more sensitive, has allowed us to obtain more data for what concerns collapses having a higher redshift. The comparison between the two detectors has indicated an average number of about 25 collapses per year, but there is however to consider that this value has to be corrected by the following:

- 4, to keep account of the "slowing down" effect on recordings due to the redshift (see **Appendix A.1**);
- about 1/0.80, considering that the detector can see rather well about 80% of the visible Universe (that is to say, up to a redshift of about $z = 12 \div 15$)), namely:

$$\frac{z^3}{(z+1)^3} \approx 0.80$$

[6] See Part 3 of **A Detector for Gravitational Waves**: *Birth and death of matter*

The new corrected value is, therefore, the following:

$$\Delta n_N \approx \frac{4\ 25}{0.80} \approx 125\ nuclei/year$$

2 Expansion of the Universe

The collapsing of a nucleus and its subsequent "exit" from the Universe causes a "release" of the space same was holding around itself. The rebounding on itself and the subsequent expansion cause the fact that the celestial objects near the MNQ move away.

The expansion of the Universe is, therefore, produced by the collapsing of the nuclei of QNMs and the "forks" recorded by our detector are a direct proof very well this phenomenon! Furthermore, these waves are useful to disperse the (gravitational) energy accumulated by the nuclei during their growth, which is transformed into (expansion) kinetic energy.

As collapse is a phenomenon related to the fact that the nuclei reach a "critical mass" conditions, *the amount of space released at each collapse is, more or less, always the same*, therefore *the more nuclei collapse in one year, the higher becomes the expansion rate of the Universe*. Therefore, *the expansion of the Universe does not proceed regularly and smoothly, but by "jumps"*: each "jump" corresponds to the collapsing of a nucleus and, in those areas of the Universe where collapses are more abundant, expansion rate results as (locally) higher. In geometrical terms, it is not very proper to speak of the *Radius of the (visible) Universe*, which could have a meaning only in the average (both for space and time).

The amount of space ΔQ_U needed for the expansion of the Universe is given by:

$$\frac{\Delta Q_U}{\Delta t} = 4\ \pi\ {R_U}^2\ \delta\ c \tag{1}$$

and as the radius R_U of the visible Universe, is related to the characteristic time of expansion, τ_U, by the following equation [7],

$$\tau_U = \frac{R_U}{3\ c} = \frac{15\ 10^9}{3} = 5\ 10^9\ years \tag{2}$$

(1) becomes [8]:

$$\Delta Q_U = 36\ \pi\ {\tau_U}^2\ \delta_\infty\ {c_\infty}^3\ \Delta t \tag{3}$$

[7] See also **Expansion of the Universe and Redshift**, where the link between τ_U and Hubble constant H_0 is reported. The calculations that are done in the next paragraphs refer to a radius of the visible Universe of $R_U = 15\ billion\ of\ light - year$ ($\equiv 1.42\ 10^{26}\ m$)

[8] We want to remind the following:

$$\delta\ c^3 = \delta_\infty\ {c_\infty}^3 = constant = 8.1\ 10^{42}\ kg/s^3\ (\equiv W/m^2)$$

where, density δ_∞ of the space "at rest" results corresponding to $3\ 10^{17}\ kg/m^3$ and $c_\infty = 300,000\ km/s$. This value of density is quite precisely obtained starting from mass m_p of the proton and from volume V_e of the electron:

$$\delta_\infty = \frac{8}{7}\ \frac{m_p}{V_e}$$

where, $m_p = 1.67\ 10^{-27}\ kg/m^3$ e $V_e = 6.24\ 10^{-45}\ m^3$.

If we consider a time interval $\Delta t = 1\ year$ and replace equation (3) with values, the following results:

$$\Delta Q_U = \frac{36\ \pi\ \left(5\ 10^9\right)^2\ \left(365\ 86,400\right)^2\ 8.1\ 10^{42}}{2\ 10^{30}} = 3.6\ 10^{56}\ M_\odot/year$$

Now, if we divide value ΔQ_U by the number Δn_N of collapsing nuclei per year, we obtain the amount of space, Q_N,which is "released" at every collapse. So we obtain:

$$Q_N = \frac{\Delta Q_U}{\Delta n_N} = \frac{3.6\ 10^{56}}{125} = 2.9\ 10^{54}\ M_\odot \tag{4}$$

which value, according to what stated previously, *represents the gravitational space of the nucleus as well and, therefore, its gravitational mass at the moment of collapse.*

We can also calculate the expansion kinetic energy ΔT_U of the Universe. We obtain.

$$\Delta T_U = \frac{1}{2}\ \Delta Q_U\ c^2 = \frac{1}{2}\ 3.6\ 10^{56}\ 2\ 10^{30}\ \left(3\ 10^8\right)^2 = 3.2\ 10^{103}\ J/year$$

and this gives us the possibility to calculate the kinetic energy developed by the collapsing of a nucleus,

$$T_N = \frac{\Delta T_U}{\Delta n_N} = \frac{3.2\ 10^{103}}{125} = 2.6\ 10^{101}\ J$$

which, as we will see, allows us to get the speed of light reached a the moment of the nucleus "exit" from of the Universe.

3 Dimensions of a nucleus

According to the analysis of the redshift of the gravitational waves that have been recorded during these years [9] the real average distance, T_0, between the "fork" peaks has resulted as *1.2 days*. If we assume a collapsing time of the nucleus corresponding to about a half of T_0 and if the speed of light at the moment of the collapse had the value we know ($c_\infty = 300,000\ km/s$), the radius of the nucleus would result as:

$$\left(R_N\right)_\infty = \frac{1.2}{2}\ 86,400\ 300,000 \approx 15\ 10^9\ km\ (\ \approx 100\ AU)$$

that is to say, corresponding to about 100 times the distance Sun-Earth. However, we know that because of the strong gravitational field these objects have, the local speed of light results very low and, therefore, it results its real dimensions are smaller. If we indicate as c_N the real speed of light on its surface, an observer placed out of the gravitational field can "see" the radius of the nucleus as corresponding to:

$$\left(R_N\right)_\infty = R_N\ \frac{c_\infty}{c_N} \tag{5}$$

To know the value of R_N therefore, we need to know the value of c_N. If we use (5) and consider that the matter of the nucleus is neglectable if compared with the mass of space, it is possible to obtain the amount of space forming the nucleus [10]:

$$\delta_N\ V_N = \delta_N\ (V_N)_\infty\ \frac{{c_N}^3}{{c_\infty}^3} = \delta_\infty\ (V_N)_\infty = constant \tag{6}$$

[9] See also Part 7 of **A Detector for Gravitational Waves**: *Redshift*

[10] Please keep in mind that the matter of a nucleus is of the order of $10^9\ M_\odot$.

therefore, due to the fact that $\delta\ c^3 = constant$, we obtain:

$$\delta_N\ V_N = 3\ 10^{17}\ \frac{4}{3}\ \pi\ \left(15\ 10^{12}\right)^3 = 4.8\ 10^{57}\ kg\ (\approx 2.4\ 10^{27}\ M_\odot)$$

consequently, the radius of the nucleus results as:

$$R_N = \left(R_N\right)_\infty\ \sqrt[3]{\frac{\delta_N\ V_N}{Q_N}} \approx 15\ 10^9\ \sqrt[3]{\frac{2.4\ 10^{27}}{2.9\ 10^{54}}} \approx 15\ km$$

while, the speed of light on the surface of the nucleus is:

$$c_N = c_\infty\ \frac{R_N}{R_\infty} = 3\ 10^8\ \frac{15}{15\ 10^9} \approx 0.3\ m/s$$

that is, a billionth of the known value! The corresponding density of space is:

$$\delta_N = \delta_\infty\ \left(\frac{c_\infty}{c_N}\right)^3 \approx 3\ 10^{44}\ kg/m^3$$

therefore, the critical (gravitational) pressure of the nucleus collapsing is:

$$p_{crit} \approx 3\ \delta_\infty\ {c_\infty}^3\ \frac{1}{c_N} = 3\ 8.1\ 10^{42}\ \frac{1}{0.3} \approx 8.1\ 10^{43}\ N/m^2$$

Which is the value of c_{exit} reached at the moment when the nucleus "exit" of the Universe? Short before, we have calculated the kinetic energy developed during collapsing, and it has resulted as corresponding to $T_N = 2.6\ 10^{101}\ J$. We have the following equality:

$$\frac{3}{10}\ Q_N\ {c_{exit}}^2 = T_N \tag{7}$$

where factor 3/10 of the (linear) distribution of the velocities inside the nucleus (see **Appendix 2)**. If we replace figure values, we obtain:

$$c_{exit} = \sqrt{\frac{10\ 2.6\ 10^{101}}{3\ 2.4\ 10^{27}\ 2\ 10^{30}}} = 1.3\ 10^{22}\ m/s$$

this value also represents the real amplitude of the "fork" near where the collapse takes place.

4 Cosmic Microwave Background radiation (CMB)

As well known, matter forming the Universe (stars, planets, dust, clouds, etc;) in its freefall on the nuclei of the MNQs gains kinetic energy that during the impact on the surface is transformed into electromagnetic energy [11]. Therefore, amoung with this continuous flow of matter falling on the surface of the MNQ nuclei there is an *equivalent* flow of electromagnetic energy generated and dispersed in the surrounding space. This energy along with the one produced by the reactions of nuclear fusion taking place inside

[11] During the impact on the surface of the nucleus, also a gravitational wave of same energy is generated, which corresponds to the *inertial mass* the object had accumulated during its fall

stars, forms the whole amount of Cosmic Background Microwave Radiation (CMB). *Time will go on, the flow of electromagnetic energy combined with the expansion effect will balance, on a large scale, the CMB density in the Universe.*

It is important to underline that *the electromagnetic radiation due to nuclear fusion reactions affect this phenomenon very slightly.* In fact, the variations of the speed of light taking place during these processes are very low. If we consider the Sun, for example, the fraction corresponding to said energy is [12]:

$$\frac{{c_\infty}^2 - {c_\odot}^2}{{c_\infty}^2 - {c_N}^2} \approx \frac{2\ \Delta c_\odot}{c_\infty} = \frac{2\ 213}{3\ 10^8} \approx 1.4\ 10^{-6}$$

4.1 Matter falling on the MNQ nuclei

The freefall of an object (i.e. a star) on a super massive celestial body such as the nucleus of a MNQ, is a process that cannot be studied with means of the present knowledge of Physics (*Theory of Relativity*), as during the fall of the body the (local) speed of light varies (decreases) progressively. In this case, as *"c" results being variable*, the equivalence relationship $\Delta E = \Delta M\ c^2$ cannot hold and, furthermore, the matter falling on the nuclei, does not "disappear" to transform itself into energy, as stated by this relationship but, on the contrary, even if it looses all or nearly all its electromagnetic energy, *its ("proper") mass remains unchanged*!

The kinetic energy T the body has gained during its fall can be indicated as follows:

$$T = \frac{1}{2}\ M\ u^2 = \frac{1}{2}\ M\ {F_v}^2\ v^2 \tag{8}$$

where M is the "proper" mass of the star (which does not vary with speed), u is the falling velocity perceived by an observer joint with same, c is the local speed of light while F_v is the "velocity factor". The existence of a "physical" space aloows us to use the "classical" expressions fr the the "velocity factor" [13]:

$$F_v = \frac{c}{c - v} \tag{9}$$

On the surface of the nucleus, F_v can be calculated in the following way:

$$F_v = \frac{c_N}{c_N - v_N} \approx \frac{c_\infty}{c_N} \approx \frac{3\ 10^8}{0.3} \approx 10^9$$

therefore, the kinetic energy the star has gained at the moment of the impact with the surface of the nucleus, which is transformed into electromagnetic energy results as follows:

$$T = \frac{1}{2}\ 2\ 10^{30}\ 0.3^2\ \left(1.2\ 10^9\right)^2 \approx 10^{47}\ J$$

[12] See, also, Appendix 1 in **Gravity**: *The fundamental role of the speed of light.*

[13] Please consider that the "relativistic" expression

$$F_v = \sqrt{\frac{c^2}{c^2 - v^2}}$$

and the "classical" one tend to match only at low speeds ($v/c \leq 0.5$). At an high speed, the "classical" expression results higher than the relativistic one.

We have seen that *in getting out of the gravitational field of a nucleus, an electromagnetic wave increase its amplitude (and its wavelength) in a way which is directly proportional to the speed of light*, therefore, the increase of its energy is quadratic with c. Therefore, the real electromagnetic energy forming the CMB results:

$$T_\infty = T\ \frac{{c_\infty}^2}{{c_N}^2} = 10^{47}\ \frac{\left(3\ 10^8\right)^2}{0.3^2} = 10^{65}\ J \tag{10}$$

For each kg of falling matter, the electromagnetic energy produced is [14]:

$$\frac{1}{2}\ \frac{{c_\infty}^4}{{c_N}^2} = \frac{1}{2}\ \frac{\left(3\ 10^8\right)^4}{0.3^2} \approx 5\ 10^{34}\ J/kg$$

therefore, in the case of a proton impacting on the surface of the nucleus, the emitted electromagnetic radiations become:

$$\frac{5\ 10^{34}\ 1.67\ 10^{-27}}{1.6\ 10^{-19}} \approx 5\ 10^{26}\ eV$$

As one can notice, it is also possible to explain the very high energy some *cosmic rays* possess, which fact cannot be explained by Physics today. As calculations just done above refer to a nucleus that is going to collapse, the given value has to be intended as an *upper limit* for the energy of the emitted gamma rays. Consequently, stars or other celestial bodies falling on the growing nuclei generate lower energy.

4.2 Energy of the CMB radiation

The CMB radiation spectrum is quite like that of a *black body*, therefore, the power density can be calculated by means of the well known Stefan-Boltman formula [15]:

$$u(T) = a\ T^4$$

where constant a has the value:

$$a = 7.57\ 10^{-16}\ J\ m^{-3}\ {}^oK^{-4}$$

As the temperature of the above radiation corresponds to $2.73\ {}^oK$, the total electromagnetic energy contained within the visible portion of the Universe has a value of:

$$a\ T^4\ V_U = 7.57\ 10^{-16}\ 2.73^4\ \frac{4\ \pi}{3}\ \left(1.42\ 10^{26}\right)^3 = 5\ 10^{65}\ J$$

The above value needs to be corrected according to redshift, *which causes an average 4 time increase of the wavelength* (see **Appendix A.1**). According to *Wien displacement law* ($\lambda\ T = constant$), we know that the wavelenght λ is inversely proportional to the temperature T, therefore the corrected value of this energy results as follows:

$$E_{CMB} = 5\ 10^{65}\ 4^4 = 1.3\ 10^{68}\ J\ (\equiv 7.2\ 10^{20}\ M_\odot)$$

[14] As it is possible to see, the developed energy is directly proportional to c^4. This is due to the effect of the denominator of (9), which becomes much smaller, not only for the increase of v, but because c is reduced!

[15] The reason why the CMB radiation can be well matching with that emitted by a black body is due to he presence of the redshift produced by the expansion of the Universe, which increases its wave length, *lambda*, by a factor $c/(c - v)$. See what reported on this subject in Appendix 33 of the book **Atomic Physics** by Max Born.

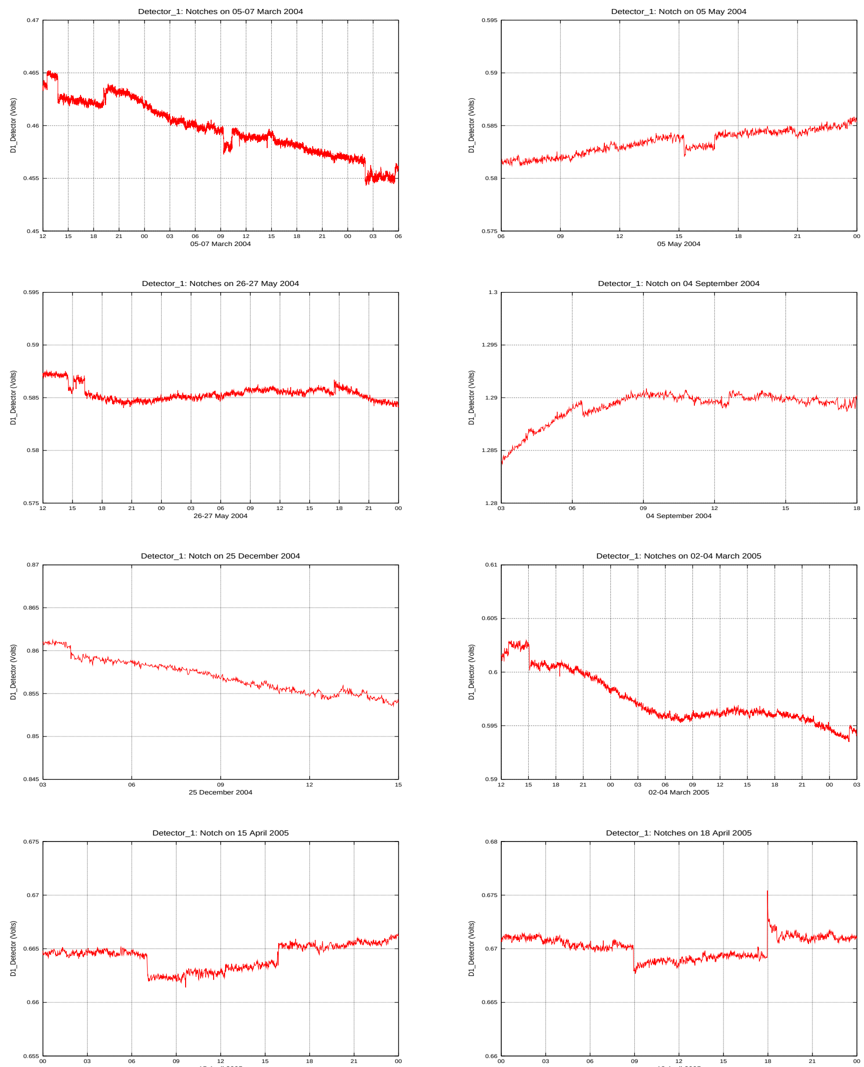

Figura 6: Samples of “notches” recently recorded (2004-2005).

5 The birth of “new” matter

In a continuous expanding Universe, where “old” matter is eliminated through the mechanism of cosmic collapses, the birth of “new” matter becomes an essential element for its proper working. The birth of this matter under the form of *neutral hydrogen clouds* is withnessed by the presence of several “notches” overlapping the waves of high intensity recorded by our detector [16]. In **Figure 6** some of the most noticeable “notches” recorded in the latest years (2004-2005) are reported. Hereunder we indicate some of the characteristics of this phenomenon:

1. the “notches” amplitude is of a few mVolt and it keeps constant for the time the phenomenon lasts;

[16] See also Part 5 of **A detector for Gravitational Waves**: *Birth and death of matter.*

2. the time duration of the “notches” varies from a few minutes to a some hours;

3. the “notches” show the redshift phenomenon: lower amplitudes correspond to less slope down (and rise up) fronts of the signal;

4. the relatively high amplitude of the “notches”, suggests us that when matter comes in, very likely, the same is “wrapped” by the space (which fact is necessary in order that neutral hydrogen can born!);

5. the slope down of “notches” represent the moment when the (electromagnetic) pressure of matter, “buried” inside the space where we see its birth, succeeds in prevailing over the gravitational pressure of space, while the rise up of “notches” corresponds to space “re-closing” once the phenomenon is extinguished;

6. the amplitude of the step, corresponding to a local decreasing of the speed of light, is produced by the expansion of matter (and space) coming into the Universe, while the constant amplitude indicates that the amount that comes into per unit of time is constant;

7. the phenomenon is stimulated by high intensity gravitational waves produced by the collapsing of the nuclei of the MNQs and these passing waves leave behind them a wake of neutral hydrogen “bubbles” which , while expanding, produce the observed “notches”;

8. the “notches” can be observed as overlapping the slope down fronts of the “forks” showing that matter comes in near the MNQs, where the wave intensity and, therefore, the (gravitational) depression produced locally results higher.

With passing the time, the biggest hydrogen clouds will form young galaxies, while smaller ones evolve into young star clusters which, in their turn, will be attracted by the biggest galaxies. The first observations concerning the presence of these clouds date back to the end of the 1970ies. During the 1980ies *low surface brightness galaxies* (or LSB) representing the first phases of their forming were discovered. Only at the beginning of the 1990ies, after the radio telescopes were tuned on the hydrogen 21 cm wavelength, it was possible to start the first surveys on these new celestial objects [17].

If, for example, we consider a “notch” with a redshift $z = 1$ (that is to say, produced at a distance of $r_0 = R_U\ z/(z+1) = R_U/2)$) which amplitude corresponds to 2 $mVolt$. As the detector constant is about 30 $km/s\ per\ mVolt$, the variation of the speed of light, corrected for the redshift, results as:

$$\Delta c = 2\ \left(z+1\right)\ 30 = 120\ km/s$$

which produces a variation of space density of:

$$\Delta\delta \approx 3\ \delta_\infty\ \frac{\Delta c}{c_\infty} = 3\ 3\ 10^{17} \frac{120}{300,000} \approx 3.6\ 10^{14}\ kg/m^3$$

When a “notch” lasts for one hour, the quantity of matter and space associated with it result as follows:

$$\frac{4\ \pi\ {r_0}^2\ c\ \Delta\delta\ 3,600}{M_\odot} = \frac{4\ \pi\ \left(1.42\ 10^{26}/2\right)^2\ 3\ 10^8\ 3.6\ 10^{14}\ 3,600}{2\ 10^{30}} = 1.2\ 10^{49}\ M_\odot$$

[17] In this respect, see the article “The Ghostliest Galaxies” by Gregory D. Bothum.

Up to this date, according to what observed, the *equivalent hours per year of "notches"*, might be between a few tens to a few hundreds. In this case the amount of matter and space that come into the Universe would result as about $10^{50} \div 10^{51}\ M_\odot/year$ [18]. Finally, if we make a first comparison with the amount of space needed for the expansion ($3.6\,10^{56}\ M_\odot/year$) we can see that this contribution results negligible. For the expansion of the Universe, we have to think for a different mechanism to generate the space.

6 A balance of matter for the Universe

The balance referred to matter hereunder proposed concerning the visible part of the Universe, uses a model with *3 groups of matter*. The first group is represented by "elusive" matter (M_X) formed by neutral hydrogen which is in the form of clouds and in *low surface brightness galaxies*. The second group is represented by "luminous" matter (M_Y) involved in nuclear fusion processes taking place inside the stars; most of this matter is the one that is found in galaxies, star clusters, globular clusters, etc... that can further be divided into Hydrogen (H), Helium (He), and the so called "Metals" (planets, dusts, etc..). The third group is represented by "collapsed" matter (M_Z) which can be found inside the huge gravitational fields of quasars; as already said, this is "dead" matter, that is to say without any electromagnetic energy because of the very low speed of light in the place where it is located.

Figure 7 shows the model we have used for this balance. In *steady-state conditions*, the following relations (with reference to a time interval $\Delta t = 1\ year$) can be stated for the three above groups of matter:

$$\Delta M_X = K_{MNQ}\ M_Z\ M_X + \frac{M_X}{\tau_Y} + \frac{M_X}{\tau_U} \tag{11}$$

$$\frac{M_X}{\tau_Y} = K_{MNQ}\ M_Z\ M_Y + \frac{M_Y}{\tau_U} \tag{12}$$

$$K_{NMQ}\ M_Z\ M_X + K_{MNQ}\ M_Z\ M_Y = \Delta M_Z + \frac{M_Z}{\tau_U} \tag{13}$$

where, τ_Y represents galaxy formation time starting from neutral hydrogen clouds, while ΔM_X and ΔM_Z are, respectively, the flow of matter which "enter" and "exit" the Universe in one year. It is important to keep in mind that M_Z represents the "proper" mass of the MNQs and not the gravitational one, which effect is included in the "catch constant" K_{MNQ} . The use of the same value of K both for M_X and M_Y is justified by the fact that it seems *neutral hydrogen has preferably its birth near the MNQs.*

6.1 The "collapsed" matter

Owing to what previously said, all matter existing in the Universe will, sooner or later, fall onto the nuclei of the MNQS. Therefore, it results that *the flow of the CMB radiation*

[18]Please, keep in mind that, here too, the equivalent hours/year must be divided by

- 4 to correct the effect produced by the redshift
- the fraction of visible Universe the detector is able to see

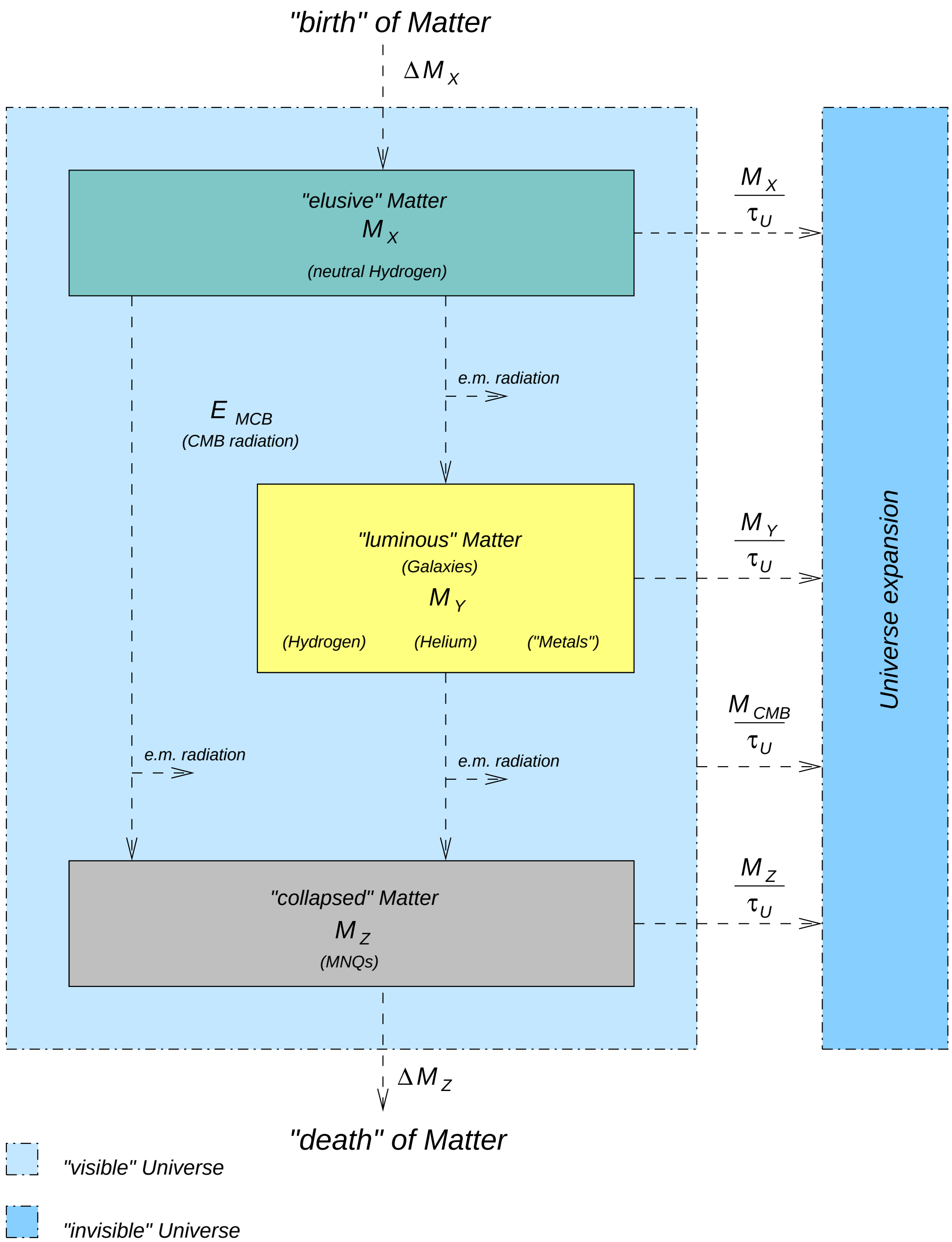

Figura 7: The reference model for the Universe

that is dispersed by effect of expansion is "equal" to this continuous flow of matter. More precisely:

$$\frac{M_{CMB}}{\tau_U} = K_{NMQ}\ M_Z\ M_X + K_{MNQ}\ M_Z\ M_Y \tag{14}$$

which if used in (13) allows us to obtain:

$$\frac{M_{CMB}}{\tau_U} = \Delta M_Z + \frac{M_Z}{\tau_U} \tag{15}$$

Considering the fact that the population of MNQs in the Universe cannot very high ($M_Z << M_{CMB}$) otherwise, in a very short time, they might attract all existing matter, we can neglect the flow of these latter ones which is dispersed by the expansion effect, thus obtaining the flow of the matter which collapses and "exit" in one year:

$$\Delta M_Z \approx \frac{M_{CMB}}{\tau_U} = \frac{7.2\ 10^{20}}{5\ 10^9} \approx 144\ 10^9\ M_\odot/anno \tag{16}$$

If said value is divided by the number Δn_N of nuclei collapsing in one year, it is possible to obtain a value for the *"proper" mass of a nucleus which is going to collapse*:

$$M_N = \frac{\Delta M_Z}{\Delta n_N} \approx \frac{144\ 10^9}{125} \approx 1.2\ 10^9\ M_\odot \tag{17}$$

How many MNQs are there in the visible Universe? If ,as we think today, the energy of electromagnetic radiation produced from the centre of a galaxies cluster is about 10,000 times higher than that emitted by a galaxy such as ours, the "consumption" of matter of an MNQ might correspond to:

$$10,000\ 100\ 10^9\ 3.86\ 10^{26}\ 86,400\ 365 \approx 1.2\ 10^{49}\ J/anno\ (= 68\ M_\odot/year)$$

where, we are referring to a galaxy formed by about 100 billion stars, while $3.86\ 10^{26}\ J/s$ is the energy emitted by a star like the Sun. Therefore, if we compare the value above obtained with the flow of matter collapsing in one year, in the visible Universe there should be about a *few billion MNQs* (namely, galaxy clusters). It is necessary to keep in mind that *this is certainly a value over esteemed* as not all the energy emitted by the MNQs has been here considered (super-luminal jets, etc...).

6.2 The "luminous" matter

The high ratio between Hydrogen (H) and Helium (He) in the Universe indicates us that *the average life time of "luminous" matter is considerably shorter than the (average) time hydrogen needs to "burn" through nuclear fusion processes taking place inside the stars.* This ratio is, today, set as corresponding to:

$$Y = \frac{M_{He}}{M_Y} \approx 0.25 \tag{18}$$

In this case we can neglect the so called "Metals" and write:

$$M_Y \approx M_H + M_{He} = \frac{1}{1-Y}\ M_H \tag{19}$$

therefore,

$$M_H \approx \frac{1-Y}{Y}\ M_{He} \approx 3\ M_{He} \tag{20}$$

If we indicate as τ_F the characteristic time for the Hydrogen to Helium conversion process taking place inside the stars, it is possible to write down the following equation concerning Helium:

$$\frac{M_{He}}{\tau_U} + K_{MNQ}\ M_Z\ M_{He} = \frac{M_H}{\tau_F} \approx 3\ \frac{M_{He}}{\tau_F} \tag{21}$$

which, if used in (20) allows obtaining the following:

$$K_{MNQ}\ M_Z = \frac{3}{\tau_F} - \frac{1}{\tau_U} \tag{22}$$

If we combine (12) and (13) and use (22) as well, it is possible to obtain the amount of "luminous" matter that is present in the Universe:

$$M_Y = \frac{M_{CMB}}{\left(3\ \frac{\tau_U}{\tau_F} - 1\right)\left(3\ \frac{\tau_Y}{\tau_F} + 1\right)} \tag{23}$$

If we consider a $\tau_F \approx 5\ 10^9$ *year* and a $\tau_Y \approx 15\ 10^9$ *year*, we obtain:

$$M_Y \approx \frac{7.2\ 10^{20}}{20} = 3.6\ 10^{19}\ M_\odot$$

and also:

$$K_{MNQ}\ M_Z = \frac{3}{5} - \frac{1}{5} = \frac{1}{2.5\ billion\ year}$$

Notwithstanding there are still some uncertainties, today, both about the processes of nuclear combustion taking place inside the stars and about the forming of galaxies, the previously made considerations point out a very important fact: *there are not large amount of luminous matter" present in the Universe*, especially if we take in consideration the presently circulating values [19].

6.3 The "elusive" matter

To calculate the "elusive" matter present in the Universe, if we replace (22) with (12), we obtain:

$$M_X = 3\ \frac{\tau_Y}{\tau_F}\ M_Y \approx 3\ \frac{15}{5}\ 3.6\ 10^{19} = 3.2\ 10^{20}\ M_\odot \tag{24}$$

that is to say, (at least) it is one order of magnitude more than "luminous" matter. Furthermore, (24) indicates us also that *the bigger is the quantity of "elusive" matter the longer is time τ_Y for the formation of galaxies from neutral hydrogen clouds.*

Finally, from (11), we can obtain the amount of neutral hydrogen that should be born in one year to compensate the Universe matter "losses". We obtain:

$$\Delta M_X = 10^{-9}\left(\frac{1}{2.5} + \frac{1}{5} + \frac{1}{5}\right) 3.2\ 10^{20} \approx 250\ 10^9\ M_\odot/year$$

For example, in a time period corresponding to:

$$t_{2U} = \tau_U\ ln2 = 15\ 0.693 \approx 10\ billion\ year$$

we know that the Universe doubles its radius, therefore volume V_U becomes 8 times bigger. It will result being formed as follows: 7/8 with "new" born matter, while only a remaining 1/8 is still occupied by "old" matter.

[19] With the cosmologic model of the Big-Bang, the amount of matter present in the Universe is calculated on the basis of gravitational considerations calculated on a large scale

$$M_Y = \frac{3\ {H_0}^2}{8\ \pi\ G}\ V_U = \frac{3\ 15\ 10^9\ 31.5\ 10^{62}}{8\ \pi\ 6.67\ 10^{-11}}\ \frac{4\ \pi}{3}\ \left(1.42\ 10^{26}\right)^3 = 9.6\ 10^{52}\ kg\ (= 4.8\ 10^{22}\ M_\odot)$$

as no distinction is done between matter (that is to say, the "proper" mass) and the gravitational mass.

7 Universe (automatic) control

How can the Universe work in a steady-state conditions?. Namely, how is it possible to avoid that the MNQs that are present eventually attract each other to form enormous and dangerous concentrations of matter? We are going to see, hereunder, that *the expansion of the Universe plays a very important role for its stability.*

A cosmic collapse seems to be the only event involving both “death” and “birth” of matter, up to now. Namely, collapsing expels old matter and, at the same time, it stimulates the production of neutral hydrogen and therefore, the formation of new galaxies. The collapse of a nucleus further than weakening the MNQ gravitational field owing to the fact there is one missing nucleus, it also “releases” the thickened space previously surrounding same, so that the galaxies of that cluster go away and, consequently, their “metabolism” slows down. The chain of collapses affected by the general collapse, cause a very strong effect of local expansion causing dispersion of the remaining nuclei and galaxies. These nuclei can stay alone for a long time before other neutral hydrogen clouds, formed in the meantime, may produce new galaxies, thus reactivating the collapsing cycle.

A MNQ having at its disposal a lot of matter has, as consequence, an high rate of collapses, expelling from the Universe more nuclei while a MNQ having few matter in its surrounding has a slower rate of collapses, as it has to wait for the formation of new galaxies. An high rate of collapses produce, also, high expansion rates with visible Universe becomes smaller but it is more dynamic and consumes more energy. On the contrary, with a lower rate of collapses the visible Universe become larger, less dynamic but consumes less energy.

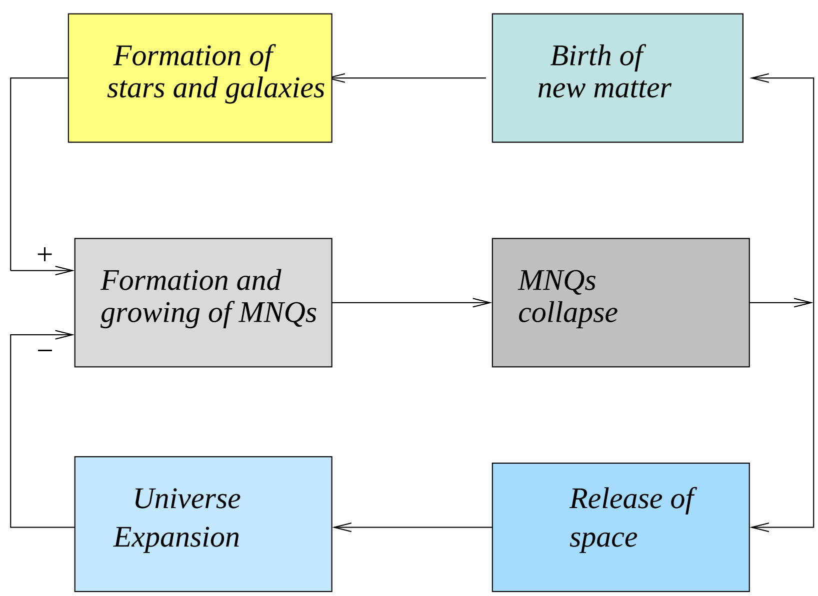

Figura 8: The Universe (automatic) control

Figure 8 reports a scheme of the mechanism concerning the Universe (automatic) control. It is the typical phenomenon of an action:

the more collapses there are $>$ *the more matter is born* with a reaction:

more collapses $>$ *more expansion*

Considering long periods, these two opposite effects will tend to balance the quantity of matter present in the Universe while, at local level, in an area corresponding to the radius of an MNQ, there will be full cycles of collapses followed by long periods of standstill.

8 Remarks

According to the model proposed in the previous paragraphs we want to stress the following points:

1. Stefan-Boltzmann's formula, used for calculation of the CMB radiation does not take into consideration the higher electromagnetic energy existing at very small wavelengths, as recently detected by the WMAP. Therefore, the value calculated should be shortcoming.

2. The balance of CMB radiation does not take into consideration the *heating produced by the interaction of gravitational waves with matter.* As already noticed, gravitational waves propagating into the Universe, interact with celestial bodies having a magnetic field even heating them remarkably, as it happens for the Sun and some planets of the Solar System.

3. The amount of "luminous" matter present in the Universe highly depends on the characteristic time Hydrogen needs to convert into Helium in the nuclear fusion processes taking place inside stars. This parameter has namely to be calculated as (weight) average between the rather long one (in the order of billion years) concerning steady-state stars such as the Sun and the much shorter one (in the order of a few tens of billion years) concerning unsteady stars, such as the blue giants. The value of 5 billion years we have used for our calculations might be in excess and, therefore, the value for "luminous" matter might result lower.

4. Converting time from Hydrogen into Helium has not the same as the average life of stars, which also depends on the amount of interstellar hydrogen these latter are in a position to catch during their existence. Furthermore, star heating produced by gravitational waves, further than favouring the process of nuclear fusion, also tends to extend the life of stars.

5. Notwithstanding many doubts still existing in our calculations, the amount of "luminous" matter present in the Universe is much lower (at least 1,000 times) than the values today circulating, mainly based upon gravitational considerations made with the Theory of Relativity, without knowing anything about the nature and the amount of "dark" matter.

6. Still preliminary esteems about the quantity of neutral hydrogen present in the universe, indicate values that are (at least) by one order of magnitude higher than "luminous" matter ones. The calculation mostly depends on galaxies formation time, starting from neutral hydrogen clouds. At present, surveys on the presence

of "elusive" matter lead to same order of magnitude values or just a little more than "luminous" matter, rather with a trend to increase.

7. In the matter balances we have done, the presence of "collapsed" matter forming the MNQ nuclei has been judged as negligible. We underline once more, that it is the "proper" mass (that is to say, properly called matter) and not of the gravitational one, which value is much higher. If the quantity of MNQs existing in the Universe was really high, given their gravitational fields, they should lead to the collapsing of all the matter present in the Universe in a quite short time! To get a more careful esteem of the MNQs present in the Universe, it is necessary to wait for completion of the ongoing surveys or for more reliable data given by the anisotrophy of the CMB radiations, as each "hot spot" on the map corresponds to the presence of a MNQ.

8. Finally, up to now a *balance of the space* related to the Universe has not yet been obtained. Calculations were done with reference to the amount of space necessary to its expansion and it was possible to verify how expansion is mainly due to "releasing" of gravitational field by collapsing nuclei and that the space wrapping the hydrogen of the "notches" is not sufficient to cover such needs.

9 Conclusions

We started this report, with the intention to improve the balance of matter in the visible Universe we had calculated sometime ago and, now, we have much more in ours pokets. The Universe model we dispose of, even if still uncertain for what concerns quantities is, on the contrary, very satisfactory for what is related to its operating. It seems very useful and stimulating the idea of labelling the MNQs as "predators" and galaxies as "preys", where neutral hydrogen is considered as the "food" at their disposal, for these latter ones of course. We can also say that it seems the way the Universe works, does not look different from any other ecosystem in (dynamical) equilibrium! Furthermore, contrary to what is today proposed by the Big-Bang, the path of matter is, here, completely upside down: Quasars are not the first ring, but the last one of the Universe "food chain".

The Universe keeps always young as shown by the mechanisms described and by what astronomical observations start proving. We have seen that, after a 10 billion year cycle only 1/8 cent of the "old" matter is still existing, while the other 7/8 concern "new" matter. The next cycle shows that "old" matter is reduced by 1/64 mainly formed by the surviving MNQs. It is as if after more or less 10 billion years, everything should start again!

In case there is someone looking for Fundamental Laws for the Universe, in this case he might take the following one as granted: *any place you go, any time you are you will always find a "young" Universe.*

A APPENDIX

A.1 Calculation of correction for redshift

Let us consider generic volume dV for the visible Universe (see **Figure 9**):

$$dV = 4\ \pi\ r^2\ dr \tag{25}$$

If we introduce as independent variable redshift z instead of distance r:

$$r = R_U\ \frac{z}{z+1} \tag{26}$$

and take its differential:

$$dr = R_U\ \frac{dz}{(z+1)^2} \tag{27}$$

By using it into (25) we obtain:

$$dV = 4\ \pi\ {R_U}^2\ \frac{z^2}{(z+1)^4} = V_U\ \frac{3\ z^2}{(z+1)^4}\ dz \tag{28}$$

Which is the number of emitters seen by the observer O? If we indicate as n the real number of emitters (e.g. collapsing MNQ nuclei) per unit of volume, the number dN of emitters contained in volume dV is given by:

$$dN = n\ dV \tag{29}$$

Therefore, it results:

$$N_O = \int_0^{R_U} n\ dV = n \frac{4\ \pi}{3}\ {R_U}^3\ \int_0^{\infty} \frac{3\ z^2}{(z+1)^4}\ dz \equiv N \tag{30}$$

that is *the observer O see the real number of emitters*, as it easy to verify that:

$$\int_0^{\infty} \frac{3\ z^2}{(z+1)^4}\ dz = 1 \tag{31}$$

How many emitters can be detected by O per unit of time? Because due to the redshift, the time duration of the event perceived by O results being higher. For the volume dV considered by us we have:

$$d\dot{N}_O = \frac{dN_O}{dt_O}\ dV = \frac{dN}{dt}\ \frac{dt_O}{dt}\ dV = \dot{N}\ \frac{1}{z+1}\ dV \tag{32}$$

If we integrate the above expression, we obtain:

$$\dot{N}_O = \dot{N}\ \int_0^{\infty} \frac{3\ z^2\ dz}{(z+1)^5} = \frac{1}{4}\ \dot{N} \tag{33}$$

therefore, *the frequency of emitters detected by O results 4 times lower than the real one.*

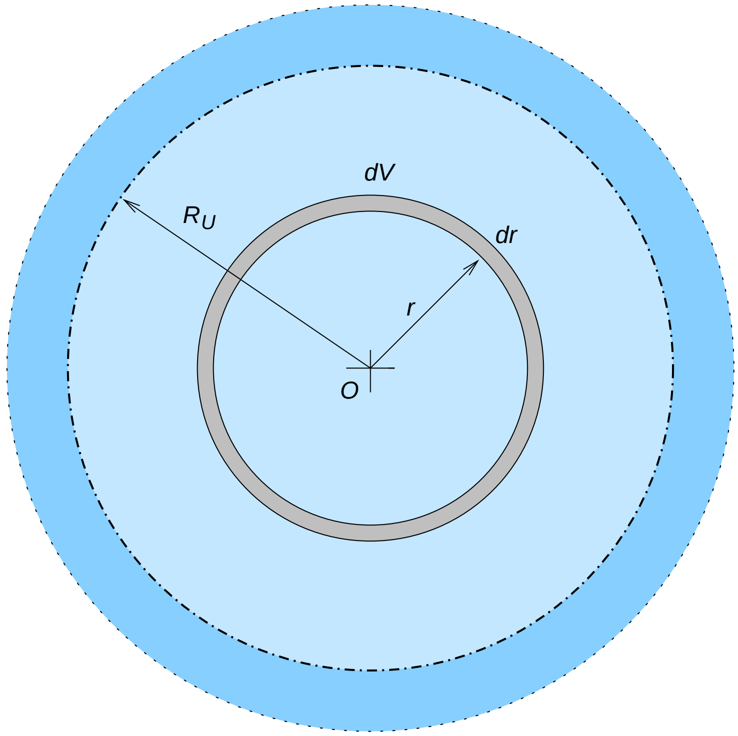

Figura 9: The volume dV for the visible Universe

A.2 Kinetic energy of a nucleus during collapse

If we consider the generic volume of the nucleus $dV = 4\ \pi\ r^2 dr$ (see also **Figure 9**), for the kinetic energy we can write the following:

$$dT_r = \frac{1}{2}\ dQ\ {c_r}^2 \tag{34}$$

where,

$$c_r = c_R\ \frac{r}{R} \tag{35}$$

with R the nucleus radius and,

$$dQ = 4\ \pi\ r^2\ dr\ \frac{Q_N}{(4\ \pi/3)\ R^3} \tag{36}$$

If we replace (35) and (36) into (34), by integrating we obtain:

$$T_N = \frac{3}{2}\ Q_N \int_0^R \frac{r^4}{R^5}\ dr = \frac{3}{10}\ Q_N\ {c_R}^2 \tag{37}$$