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THE SPEED OF THE LIGHT

NEW IDEAS

Gianpaolo Benincasa

" Behind it all is surely an idea so simple, so beautiful, that when we grasp it- in a decade, a century or a millennium- we will all say to each other: how could it have been otherwise? "

John Wheeler

Abstract

The speed of the light is a universal constant, that has a fixed value at any time and any place in the universe. This value is of approximately 300000 km/s Moreover, as it is known, this speed does not change if the beam of light is emitted by your flashlight, or comes from a star distant from us a billion light years. This is precisely the foundation of Restricted Relativity of Einstein.
Then , there cannot be question on the absolute constancy of this speed ... today.
In our article we are advancing instead the hypothesis that this speed can have changed over time. More precisely we assume that the light has followed the expansion of space, that is its support, in a completely proportional way , following the Hubble law. From a very small value at the time of the Big Bang, then it would come to its present value.
We suggest then a new idea of the meaning of inflating space: the space is unique for us and if it swells between galaxies, it must also swell within them.
As a consequence of our hypothesis, even two points of a star or a planet follow the same law; as the extreme consequence it should finally admit that **the interatomic space inflates.**
It is obvious that this assumption leads to fundamental changes in virtually all branches of physics. We must therefore admit that other universal constants have changed their value over time, but in such a manner as to leave unchanged their constant dimensionless ratios that are commonly regarded as absolutely immutable over time.
In our article we analyze some of these variations and the resulting consequences .
Some of these consequences are really relevant.
The most important is that there is no more need to hypothesize the presence of a mysterious dark matter in the universe to explain the anomaly in the velocity of rotation of spiral galaxies. Our hypothesis explains exactly why the sun rotates at a speed of about 220 km/s, instead of 160 km/ s, as is evident considering the total mass of the galaxy. Not only that, but our hypothesis clearly shows exactly why all the stars in the galaxy rotate at a velocity of about 220 km/s, regardless of their distance from the center of the galaxy.
In the same way our hipothesis also explains the anomaly in the behaviour of the gravitational lenses and in the clustering of galaxies, that are usually considered as «proofs » of the existence of dark matter.
Last, but not least, we give a new interpretation of the Big Bang, that is now situated in an infinitely past time., much more realistic hypothesis than the "magic" 13.7 GY.
All this seems totally justify the previously mentioned sentence of John Wheeler.

LA VITESSE DE LA LUMIÈRE

De nouvelles idées

Gianpaolo Benincasa

Derrière tout cela il y a certainement une idée si simple, si belle, que lorsque nous la comprendrons, dans une décennie, un siècle ou un millénaire, nous nous dirons les uns les autres: comme on aurait pu en être autrement ?

John Wheeler

Résumé

La vitesse de la lumière est une constante universelle , c'est a dire qu'elle a une valeur fixe à tout moment et en tout lieu dans l'univers. Cette valeur est d'environ 300000 km /s. En outre, cette vitesse ne change pas que le faisceau lumineux soit émis à partir de votre torche, ou vient d'une étoile lointaine de nous un milliard d'années lumière. Ceci est la fondation de la Relativité restreinte d' Einstein.
On ne peut donc douter de la constance de la vitesse de la lumiere ... aujourd'hui.
Dans notre article, nous avançons l'hypothèse que cette vitesse peut avoir change' au fil du temps. Plus précisément, nous supposons que la lumière a suivi l'expansion de l'espace, qui est son support, d'une facon complètement proportionnelle, suivant la loi de Hubble.
D'un très faible valeur au moment du Big Bang, elle serait alors arrivé à sa valeur actuelle.
Ensuite, nous avançons une nouvelle vision de l'espace: l'espace pour nous est unique, et s'il se gonfle entre les galaxies, il doit aussi se gonfler a' l'interieur des galaxies.
En conséquence de notre hypothèse, deux points situés à l'intérieur d'une étoile ou d'une planète s'éloignent en suivant la même loi; comme une conséquence extrême on doit enfin admettre que **même l'espace interatomique se gonfle**
Il est clair que cette hypothèse conduit à des changements fondamentaux dans pratiquement toutes les branches de la physique. Il faut reconnaître que d'autres constantes universelles ont changé leur valeur au fil du temps, mais de façon à laisser constants leurs rapport adimensionnels, ce qui est généralement considéré comme absolument immuable au fil du temps.
Dans notre article, nous analysons certains de ces changements et les conséquences qui en découlent.
Certaines de ces conséquences sont vraiment importantes.
La plus important est qu'il n' y a plus besoin de supposer la présence d'une mystérieuse matière noire dans l'univers pour expliquer l'anomalie de la vitesse de rotation des galaxies a' spirales. Notre hypothèse explique exactement pourquoi le soleil tourne à une vitesse d'environ 220 km/s, plutôt que 160 km/s, comme il resulte évident compte tenu de la masse totale de la galaxie. Non seulement cela, mais notre hypothèse montre clairement et exactement pourquoi toutes les étoiles de la galaxie tournent à une vitesse d'environ 220 km/s, indépendamment de leur distance du centre de la galaxie.
De la même manière, nous montrons qu'il n' est pas nécessaire d'hypothiser la présence de matière noire pour expliquer les anomalies constates sur les lentilles gravitationnelles et le regroupement des galaxies..

Dernière, mais extrêmement important, conséquence de nos hypothèses est le nouveau sens donné au Big Bang, qui est situé à une époque infiniment lointaine, hypothèse beaucoup plus plausible du « magique » 13,7 milliards d'annees..
En fin de compte, il semble que tout justifie la phrase de John Wheeler, cité au début

Keywords: speed of light, Hubble law, dark matter, expansion of universe, gravitation,

The constancy of the speed of light

Among the fascinating phenomena of modern physics, a particularly important place deserves,in our opinion, the constancy of the speed of light.
This constancy is one of the foundations of Relativity Restricted (RR) and it has been verified many times since that distant 1905, when Einstein formulated this postulate, to this day.
The speed of light **c** is a universal constant, then valid at all points of the universe, the same way as other universal constants such as the constant of gravity, the constant of Planck, the Boltzman's constant, etc...
Each of these constants has some mysterious sides, first of all why they have the value they have.
The Anthropic Principle provides, in the absence of an explanation, at least one justification for this apparently arbitrary choice of nature.
There seems, however, that the constancy of the speed of light presents in more a few oddities, so to speak, compared to other universal constants.
Oddities that are not so much attributable to the value assigned by the seemingly arbitrary nature, but rather to the many consequences of fundamental importance that such constancy entails. We briefly mention a few:
Photons and other quanta exist only at the speed **c** (in vacuum): there are no photons slower or faster.
The quanta have no mass and move only at the speed **c.** We know that they can only change

their energy by changing the frequency according to the formula of Planck ($E = h\nu$); and this gives us the spectrum of radiations ranging from radio waves at low frequency up to very high energy gamma rays, passing through the visible light, X-rays, etc ...
At the speed **c** an object is shortened until reduced to zero length (RR).
At the speed **c,** time stops (RR).
At the approach to **c,** the mass tends to infinity (RR).
This circumstance makes it impossible for even one day can come close to that speed (except in particle accelerators where, for example, a proton can be accelerated at nearly the speed **c** and its mass increases by thousand times).
As you can see, these few examples already sufficiently clarify what was said on the peculiar character of the constancy of **c** and justify the strong interest that we bring to this phenomenon.
That **c** is a universal constant, we do not believe it is permissible to doubt it.
The speed of light has been measured, especially in modern times with high precision and never any deviation is detected by **c** (remember that **c** = ~ 3x10esp5 km/s).
This measure also does not vary if the ray of light comes from a source on the ground or from a star which is located, for example, to a billion light years away.
We repeat, there is no doubt on the constancy of c!
We do wish ,however, to expose an alternative hypothesis of this "dogma" of the constancy of the speed of light.

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The speed of light in time

We return to the previous sentence we had put in bold, and add an adverb of time.
...t**here is no doubt on the constancy of the speed of light ... today.**
As you can see the meaning changes dramatically and the consequences could be great.
When we measure the speed of light from a star distant a billion light years, and invariably we find the value **c,** we unconsciously or deliberately assume that the velocity of light **c** has remained constant during this trip of a billion years .
We then assume that because the speed that we measure today is always equal to **c,** that it was also at the time of issue, a billion years ago.
Let us assume that this is not true, i.e. suppose that the speed of light was different from **c** in the past.
We must say that this hypothesis does not impress us beyond measure: we have also several notable examples of quantities whose meaning has been totally changed and often overwhelmed by new observations and discoveries.
Just think for example the Relativity that has totally changed our view of space and time, and at the same universe, for centuries regarded as still and steady, and that recently has been shown to be growing.
If then the speed of light was different from **c** in the past, there are only two possibilities: it was larger or smaller than **c.**
Furthermore, since we can hardly imagine that it had a single value in the past and that, at a given time that value is changed to become equal to **c,** it seems clear that the change occurred continuously during the life of the universe.
In other words, it is increased or decreased continuously, reaching the value that we know and measure today.
The Big Bang, as we know ,is regarded as a singularity, a situation that is not well defined, in which some variables may have had infinite values (density of matter, temperature etc ...) while other values were near zero (the time, size, etc ...).
It therefore seems logical to assume that the speed of light, in our case, at the beginning had a very high or a very small value.
For reasons of consistency with the expansion of the universe we favor the second hypothesis that light would have followed the space, which is its support, during its "swelling".
So, to fix ideas, we propose a speed of light increasing with time and having a lower value a few moments after the Big Bang.
Having said that, we must first propose a law, a function of time, which expresses quantitatively this acceleration of the light.
Obviously we have endless possibilities to define such a law.
The simplest seems to us that growth is absolutely proportional to the growth of the universe.
If we denote by S (t) the general size of the universe at time t, then we have

$$c(t) \cap S(t) \qquad (1)$$

It is evident that to propose a speed of light variable over time has consequences revolutionary in virtually all fields of physics and particularly in our understanding of the universe and its evolution.

Suffice, for example, just think that doing so removes all meaning to the value of a light year, defined as distance traveled in one year by a ray of light: in fact, this distance will be totally different if the measurement is made today, or if it has been performed in the remote past.
Clearly we can not discuss here all the possible consequences of such a new and disconcerting vision of the universe, because it would be difficult to identify them all.
We therefore confine the following pages to discuss those results that seem the most important, we will seek in particular to identify where new wording is necessary to define some of the most important laws of physics so that they can, in some way, be reconciled with a speed of light variable over time.
But before we expose such consequences it seems necessary to clarify our point of view on two important topics.
The first clarification concerns the true meaning of the **Hubble constant.**
The theory of the expansion of the universe, now generally accepted and sufficiently proved, says that two galaxies, located at a distance D move away from each other according to the Hubble law.
On the other hand, this movement is not due to any proper motion of the galaxies in question, but rather a "swelling" of all the space that expands according to the law.
According to the common interpretation of the Hubble law, such movement only affects the galaxies and not the stars within a galaxy: the space does not inflate within a galaxy.
The reason is that gravity, very strong in galaxies, is opposed to such swelling.
We think differently: the space is unique for us and if it swells between galaxies, it must also swell within them.
The expansion of the universe is not affected then by the force of gravity.
This hypothesis can not be verified by measuring the famous "red shift": being in fact the distances within a galaxy relatively small (of the order of some hundreds of thousands of light years), the shift to the red would have very small values (~ 10exp-8), then are difficult to measure.
As a consequence of our hypothesis, even two points of a star or a planet follow the same law; as the extreme consequence it should finally admit that **the interatomic space inflates.**
The space cannot **"know"** if it is in a inter-galactic position, or it is inside a galaxy or also inside an object.
Ultimately then the stars, planets, and any object of the universe were smaller in the past and increase their size by following the Hubble law.
The diameter of the earth (and everything else, including plants and animals etc..) was smaller in the past. One could argue at this point that this hypothesis is in contrast, for example, with the remains of plants and animals that lived millions of years ago and seem to have dimensions similar to those of today.
This objection has a very simple answer: that is, admitting that in the past plants and animals would have had a smaller size of the current ones, we could not notice this because their fossil remains are evidently growing following, like everything else, the same law.
The second clarification concerns the **interstellar distances.**
We immediately notice that the interstellar distances that are now universally known and accepted change in our assumptions.
The interstellar distances were measured using various methods. First and foremost the parallax that is valid up to distances of a few hundred light-years (i.e. within our galaxy). The unit of measurement for this method, the Parsec, is the one used in astronomy and it is independent of the speed' of light (1 parsec = ~ 3.2 light years).
The light-year is a unit, we say, popular.

The method now more used to measure interstellar distances is the so-called red shift of the spectral lines of light from a distant star. For the Doppler effect the light coming from a star moves in the direction of the red and this displacement is precisely proportional to the distance.
According to our hypothesis is not so. The light from a distant star moves towards the red because its wavelength changes as the other dimensions of universe.
The wavelength of the photons increases as any other dimension of the universe (6). It follows also that, since

$$\lambda = \frac{c}{\nu} \qquad (2)$$

the frequency of fotons remains constant.

Even the times taken by the light of various stars to arrive to us are different and therefore, ultimately, different is the age of the universe, as we will see shortly.
We must also abandon the concept of a light year as the unit of measure for interstellar distances, and return to use the parsec or the good old meter and its multiples.

Apparent time and real-time

Consider a generic distance S between any two points. This may be the distance between two galaxies, the length of a ruler or even the sheer size of our universe, it does not matter.
According to classical physics (Hubble's law), this distance varies with time according to the relationship

$$\frac{dS}{dt} = H\,S \qquad (3)$$

which says that the speed with which, for example, two galaxies placed at a distance S depart each other, is proportional to the same distance S.
By integrating (3), and taking into account the distance S had at the beginning (near the Big Bang) the value S(BB) it is obtained

$$S(t) = S(BB)e^{Ht} \qquad (4)$$

The size then increases in the exponential function to the passage of time.
We advance the hypothesis that there has been no inflation and that, therefore, the universe is expanded continuously starting from very small dimensions and following a law of the type of (4). Further suppose that the value of H remained constant in time.
Obviously we do not want to start from the instant of the BB since, as we know, S(BB) has a value near zero, and also the conditions in those first few moments are not well understood.
We decide, arbitrarily, to start measuring the time from when the universe was very small in size, of only 1 meter. We will denote this value as S(BB1), to distinguish it from the other S(BB) of (4).
The universe defined with our hypothesis then evolves from an initial value S (BB1) and today have reached the size S(0), estimated at about 10 exp 26 m

S(BB1) = 1 m; S(0) = 10 exp26 m (5)
The (4) then becomes

$$S(T) = S(BB1)e^{HT} \qquad (6)$$

In (6) we denote time with a capital T to distinguish it from traditional (4) that we indicated with the lowercase t.
We call T the real-time and t the apparent time or traditional time.
Introducing in (6) the values given by (5), we get **the new** EU(T) **age of the universe**

EU (T) = 864 10exp9 years (7)

According to our hypothesis, then our universe is expanded without inflation, since the Big Bang, for a much, much longer time than commonly accepted. **The universe is thus of more than 864 billion years old, starting at the dimensions of 1 m!**

NB
In the above, we considered the Hubble constant H=2.2 10exp-18/s, as a constant in time.
Recent observations (Kobe satellites), seem to show that the speed of expansion of the universe grows continuously, i.e. H would be a function of time, H (t). Evidently we do not have the slightest idea of the law with which H(t) grows with time.
In our case, this fact would mean, in particular, that the age of the universe would be even greater than the first one found.
For example, if we consider H(t) increasing proportionally with the size of the universe (assumption that we have already used), this would mean an age of the universe of **more than 1,789 billions years.**
However, pending further confirmation, we prefer to stick to what found in (7)

The measurement of the speed of light

A question we can legitimately ask is that of why, if the speed of light varies with time, we have never noticed it, that is why the measures in the past have always given the value of **c(0).**
The answert comes directly from our working hypothesis, expressed by (1). The speed **c (t)** of the light varies in fact exactly as any linear dimension of the universe, including a possible standard meter. Therefore, a measurement of **c (t)** performed in the past, even a very old age, would have always delivered the exact same value that we know today.
Even without wishing to take account of our hypothesis, it would be extremely difficult to find today, a confirmation of this variability of the speed of light.
In fact, the speed of light has changed today, with respect one year ago, of only 2 cm/s: a value too small to be detected.

Parameters and fundamental constants

As mentioned above, our hypothesis of a time-varying speed of light must necessarily lead to changes (in some cases it may be a real revolution) in the classical view of the universe and its parameters, such as these are now universally accepted .
In particular, there are a number of parameters and fundamental constants that need to be totally reconsidered.
In **Appendix** we analyze some of the fundamental quantities today considered as constant and that, in our hypothesis, should instead be variable with time.

Taking into account the findings in **Appendix**, we have that

$$h\nu \cap e^{2HT}; \quad mc^2 \cap e^{2HT}; \nu = const \qquad (8)$$

and conditions of our basic assumptions become

$$c \cap e^{HT}\ ;\ m = \cos t\ ; h \cap e^{2HT} \qquad (9)$$

From this analysis we report here also the conclusions regarding the constant of gravity G and the average density of the universe.
The first becomes strongly increasing with time

$$G \cap e^{3HT} \qquad (10)$$

while the average density decreases strongly

$$\rho \cup e^{3HT} \qquad (11)$$

Consequences of our hypotheses

The rather unusual hypotheses that we propose in this chapter have consequences that may shed new light on phenomena hitherto misunderstood or, otherwise, open the door to new interpretation of facts already known.
It is quite difficult to enumerate all these consequences.
Thus we have restricted over the next few paragraphs to enumerate only some of them, leaving to others, perhaps more prepared than us, the task of finding possibly other consequences.
We repeat once again, the choices made in our assumptions of what quantities and fundamental constants can be considered as variables is rather arbitrary: our aim is just to show how to change over time some of these variables could lead to interesting results for a better understanding of our universe.

Consequence N.1 Universal Gravitation

We recall that this law, also known as Newton law, says that:

$$F = G\frac{M1M2}{D^2} \qquad (12)$$

The force with which two masses M1 and M2 attract each other is proportional to the product of the two masses and inversely proportional to the square of their distance.

In particular note that it tells us that the strength decreases as the distance and therefore, ultimately, over time.
The constant G is rightly called the universal gravitational constant and its value is always the same in all ages and at all points of the universe.
As can be seen in the expression (12), the numerator is a constant since neither the masses nor the constant G vary with time. The denominator is growing with increasing distance D.
Ultimately therefore the force of attraction between M1 and M2 decreases continuously with time because, as we know, D increases continuously according to the Hubble law.
For a generic distance S (t) at time t between two stars we know that they move away according to (4).
This is then the value of the distance D which we must introduce in the denominator of (12).
As seen, the force of gravitational attraction between two masses M1 and M2 , initially at a distance S (0), decreases exponentially with the passage of time. The (12) then becomes

$$F(t) = G\frac{M1M2}{\left(S(0)e^{Ht}\right)^2} \cap \frac{1}{e^{2Ht}} \qquad (13)$$

All this according to the classical theory. Let's see what happens in our hypothesis.
Using real-time unit T and recalling (6), one has for (16) the new expression of the law of universal gravitation:

$$F(T) = G\frac{M1M2}{(S(BB1)e^{HT)})^2} \qquad (14)$$

Recalling the (9) and (10), one has

$$F(T) \cap e^{HT} \qquad (15)$$

The continuous decrease of the mass given by (9) is more than offset by the value of the gravitation constant G (10).
The (15) tells us that the gravity force F increases with the time: it is not affected by the expansion of the universe.

Consequence N.2 The Fate of the universe

The formula (15) can also be used to give us an idea on the future evolution of our universe, particularly in what kind of universe we find ourselves.
The (15) tells us that the gravity F (T)has increased during the expansion of the universe.
Nevertheless, the expansion of the universe seems never to have slowed down: indeed, according to the most recent surveys, it seems to accelerate.
However, we wish to make some comments about it.
If the universe could be seen as an immense ball having a center, it is evident that the gravitational collapse should happen sooner or later, towards its center.
This was the reason of the introduction by Einstein of the famous cosmological constant: it indicated the existence of a mysterious force that could counteract gravity.
The modern view is rather that of an expanding universe, finite, but boundless, uniform in all directions and, importantly, not having any center.
This last feature seems particularly important.
Each point in the universe can be seen as the center of the universe itself.
This is because, at any point in the universe you are, because of the uniformity, in whatever direction you look you will find the same situation.
Particularly the measurable distance of the most distant star will result of about 14 billion years light (according to the classic theory).
The result is that the gravitational forces acting on this point will be the same, from wherever they come from: their resultant will be nothing.
Because these considerations may be repeated identically for any point in the universe, it follows that a mass, a star for example, anywhere, should not suffer any gravitational effect, beyond that produced locally.
Our universe seems to grow continuously under the law of Hubble since the Big Bang, without any force of gravity to oppose this expansion. The ours seems to be an open universe that will expand forever.

Consequence No.3 The density of the universe

The density is defined as the ratio between the mass of a body and the volume it occupies. In the case of the entire universe this average density will vary with time since, according to our hypothesis the volume varies with time.
Taking into account that the volume is proportional to the cube of the linear dimensions, we have that:

$$\rho(T) = \frac{M(T)}{V(T)} \cap \frac{M(T)}{S(T)^3}$$

Recalling (6) and (9), we finally obtain

$$\rho(T) \cap \frac{1}{e^{3HT}}$$

that is exactly identical to (11).

Consequence No. 4 - Rotation of galaxies and dark matter

The galaxies were formed between 6 and 10 billion years ago by the condensation of matter floating in the universe at that time.
Our galaxy, the Milky Way, was formed about 9 billions years ago, and it is of the type known as a spiral, i.e. it has a dense central core and some arms are wrapped around , just as a spiral. It is estimated that its radius is of about 100000 light years.
Our sun was formed about 4.5 billion years ago, and its position is in one of the spiral arms at a distance of about 24,000 light years from the galactic center.
Every star in the galaxy then rotates with a certain speed at a distance R around the center of the galaxy. This speed can be easily calculated equaling the force of gravity acting on this star with its centrifugal force.
We call:
- M (R) the mass of the galaxy that is located within the circumference having a radius R
- m is the mass of the star
-G the constant of gravity
-V the rotational speed we want calculate

It has

$$\frac{GM(R)m}{R^2} = \frac{mV^2}{R} \qquad (16)$$

From which

$$V = \sqrt{\frac{GM(R)}{R}} \qquad (17)$$

Since more than 90% of the total mass of spiral galaxies is concentrated in its nucleus, one can, to a good approximation, in (17) replace M (R) with M the total mass of the galaxy, which applies to all the stars outside the nucleus.
It is therefore obtained

$$V = \sqrt{\frac{G\,M}{R}} \qquad (18)$$

How then can see, the speed V of rotation decreases according to the inverse of the square root of the distance R from the center of the galaxy.

This situation is shown in the lower curve of Fig. 1, valid, in particular for our galaxy.
One can be seen clearly from this curve that the sun should have a speed of rotation of about 160 km /s.
In recent times, measures more and more precise of the speed of rotation, started in the 60s (Louise Volders, 1959), showed that in reality the speed of rotation are a lot more higher than those obtained with the (18).
This fact is represented by the upper curve of the Fig. 1.
As we see, for example, our sun has a velocity of rotation of 220 km/s, up from 160 km / s obtained with (18).
Not only, but there was a flattening of that curve upwards, so that most of the stars in the galaxy have a velocity of rotation between 210 and 220 km/s.
The hypothesis now almost universally accepted to explain such a phenomenon, is the presence in the universe of an immense amount of the so-called dark matter.
This dark matter, of which we not know the origin and the nature (it is assumed it could be made up of particles called super-symmetric, yet to be discovered ..), should form the most of the matter in our universe , and its gravitational effects in galaxies could justify the observed phenomenon.
Our hypothesis of a speed of light rising over time, provides an explanation much more simple to the observed phenomenon.
Recalling the (6), the (9) and (10), it is obtained for the (18) that

$$V \cap e^{HT} \qquad (19)$$

This means that the speed of rotation for each point of the galaxy at a distance R from the center has always increased over time since.
We call
V (t1) = 220 km / s, the speed of rotation of the sun measured today
V (t0) = 160 km / s, the speed of the sun which should be
and look at what instant (t 0) the velocity of the past would be valid.

$$\frac{V(t1)}{V(t0)} = \frac{220}{160} = \frac{e^{HT1}}{e^{HT0}} = 1{,}375 \qquad (20)$$

In this expression, the unknown is (t0). It is easily obtained

$$t1 - t0 = 4{,}6\ 10\exp 9\ \mathit{years} \qquad (21)$$

This value is just now considered as the epoch of stars formation, including the sun.
However this result is not satisfying , especially because it does not consider the history of the galaxy before the stars formation(remember the galaxy is old of 9-10 billions years)..
Moreover we should consider the second problem already mentioned, that is the flattening of the upward curve of the speed of rotation of galaxies (see upper curve of the Fig. 1).
On this subject we can propose a hypothesis that is based on strong simplifications and that can be considered only for its qualitative and not quantitative aspect.

The galaxy formed about 10 billions years ago, was certainly not as we observe it today. The stars formed in fact only 4-5 billions years ago.
For about 5 billions years, the galaxy was then formed from matter not coagulated.
Put simply, you can say that it presented itself for a long time as a rotating disk and , even easier, you can imagine with uniform density.
Its total mass (M) was the same as today .
Further, suppose that even its total radius, R (0) was the same as today, i.e. of about 100000 light years.
It is clear that in such conditions, the speed of rotation to any radius R was given by (17) rather than from the (18), that depended on the material contained within a circle of radius R.
In a rotating disc of matter uniform and total radius R (0), the mass contained within a circle of radius R is

$$M(R) = M\left(\frac{R}{R(0)}\right)^2 \qquad (22)$$

Then the (17) becomes

$$V = \frac{1}{R(0)}\sqrt{GMR} \qquad (23)$$

And, in view of the (6), of (9) and (10), one has

$$V \cap e^{HT} \qquad (24)$$

identical to (19).
The (23) implies that the speed of rotation grows proportionally to the square root of the distance R from the center, exactly the reverse of what happens in (18) which would then be valid only after the formation of stars .
This fact may explain the flattening of velocity upwards, as shown in the upper curve of the figure.
With an extremely simplified reasoning, you can imagine that during about 4.5 billions years was valid the (23, while in the next 4.5 billion years was the (18) to be valid.
In order to clarify this, we can do the following reasoning. First of all we have to decide which was the speed of rotation of the galaxy at the time of its formation, i.e. 9 billions years ago.
This is possible if we consider the extreme regions of the galaxy, at a dstance from the center of 100000 light years. In fact, at this distance from the center, both the (18) and the (23) give the same results because all the matter of the galaxy is contained isnside the radius R0. This speed is today of ~220 km/s.
Following our hypothesis, the (19) and (20) give a speed of ~118 km/s. Following the (23) (the galaxy was at that period in a fluid state) we find that the rotational speed at a distance of 24000 ligh years from the center, in the position that will be occupied by the sun later on, that speed was of 57.8 km/s. This situation is reported in Fig. 2A where T0 means 9 billions years ago, at the period of formation of the galaxy.

During the next 4.5 billion years the (23) is still valid, and, using the (19) , we find a speed of 161 km/s at the extreme periphery, and of 79 km/s at the sun position(T1= 4.5 billions of light years).
This situation is represented in Fig 2B, where T1 is at 4.5 billion years afer the formation of galaxy.
At this point the stars begin to form and we have to use the (18) instead of the (23).
It is evident that this change was not instantaneous , but an intermediate situation lasted for a certain time (maybe some billions of years). However, in our extremely simplified hipotesis, we consider the transition as instantaneous.
The speed of rotation of the stars has now the form that is showed qualitatively in the Fig. 2C.
After another 4.5 billion of years (i.e. today) the periferic speed will result of ~ 220 km/s and also the speed of the sun results of ~216 km/s.
Moreover, this value is the same for any star at the interior of the galaxy (Fig. 2D).
This is exactly the situation we observe totay.

As you can see, our hypothesis perfectly explains the anomaly recorded in the speed of rotation of spiral galaxies without resorting to the presence of dark matter.
This dark matter in fact, something that you can not put out in any way, reminds us of the very famous Cosmological Constant, and even the inflationary universe hypothesis: something that is introduced “ to make ends meet. “

Why spiral galaxies do not explode?

The stars that are located in the outer arms of spiral galaxies rotate at a speed very high, higher than that calculated theoretically (see Fig. 1).
Under such conditions, they should literally splash out of the galaxy and then this last should "explode".
This does not happen, and this is still attributed to the existence of large amount of dark matter that with its mass keeps the galaxy together.
According to our hypothesis, there is another explanation.
Let’s consider the (16) that compares the centrifugal force and the centripetal force acting on stars within the spiral galaxies.
It appears that, by applying the relations of Appendix, these forces increaese in the same manner with the time.
Therefore there is no reason why spiral galaxies should "explode".

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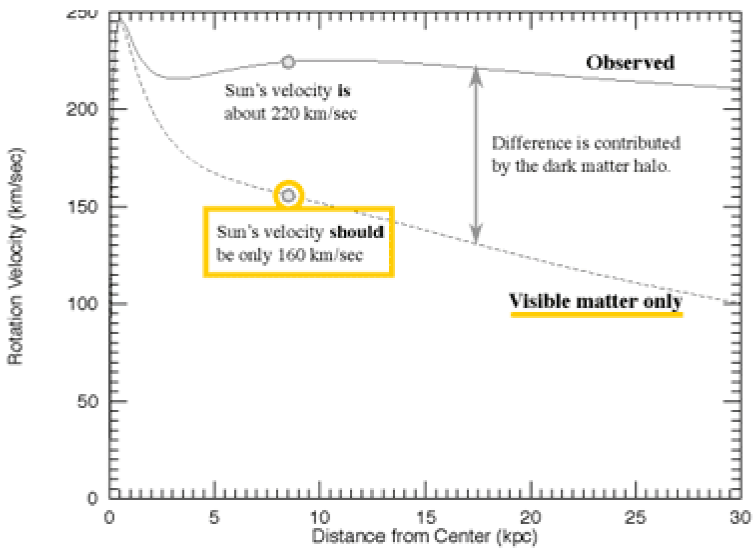

Fig 1 -Speed of rotation of spiral galaxies (Milky Way) as a function of distance from the center

(This page was copied from Nick Strobel's Astronomy Notes.)

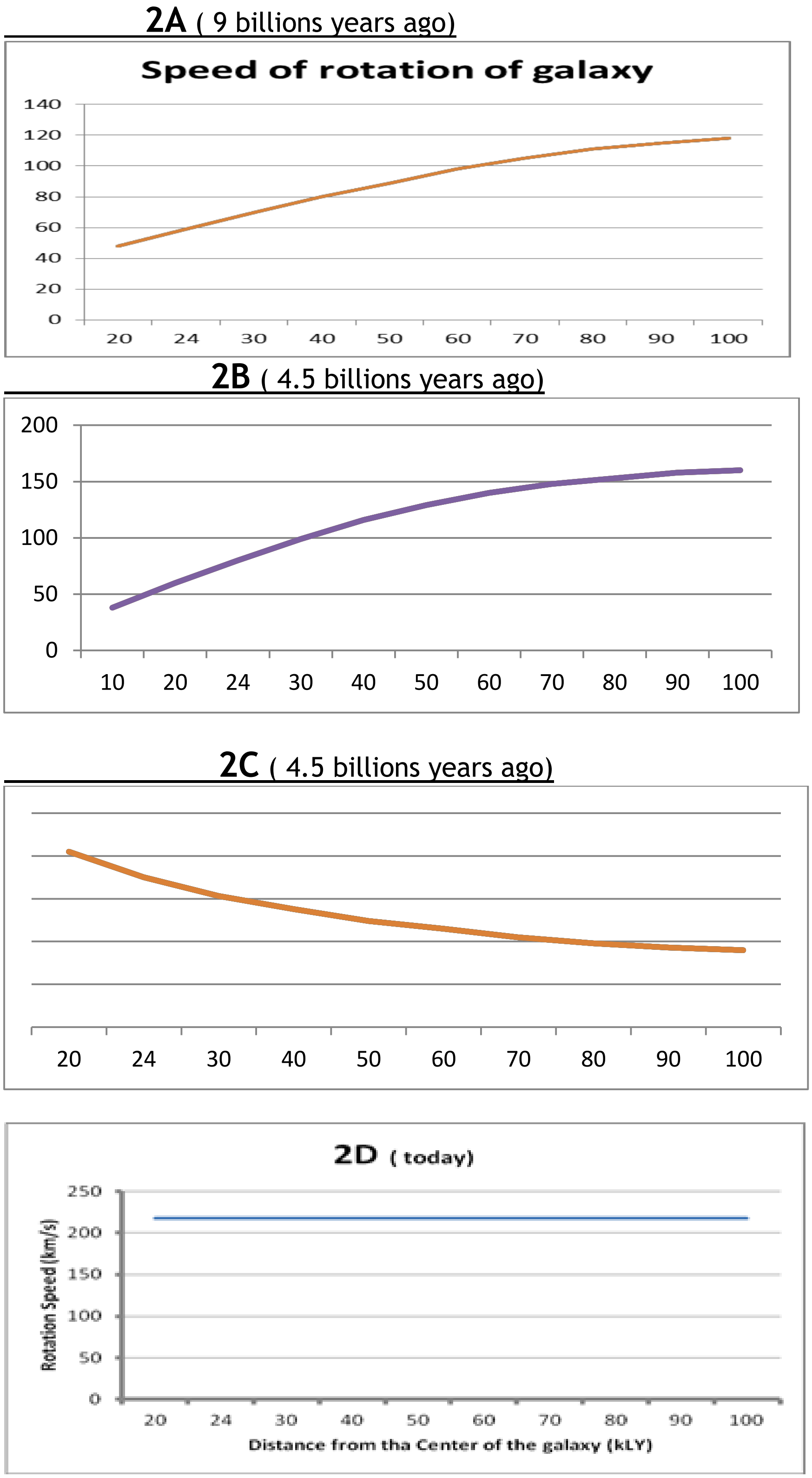

Fig.2- Variation of the rotational sped of galaxy with time

Consequence N. 5 - Gravitational Lenses

Among the "evidence" commonly considered as a proof of the existence of dark matter , there are the so-called gravitational lenses .
When a distant galaxy (billions of light-years) , a cluster of galaxies and the earth are in alignment , it happens that the light coming from the first , passing in the space distorted by gravity produced by the mass of galaxies , comes on earth as a kind of halo around the cluster of galaxies interposed in its path. That is a classic effect of General Relativity . It happens now that the distortion is greater than what one can estimate by calculating the total mass of galaxies. This anomaly is today attributed to the presence of invisible dark matter that , with its mass, accentuates the distortion of light.
Quantitatively , the deviation of a ray of light that passes at a distance R from a Cluster of galaxies of mass M is given by the formula of General Relativity

$$\alpha = 4\frac{GM}{c^2R} \qquad (25)$$

We note immediately that , as can be seen from Appendix , this angle remains absolutely constant with the passage of time even in our hypothesis.
The total mass M of the galaxies is estimated with a good approximation by measuring the light emitted .
It results that the angle of deviation of the light is much higher than that resulting from (28) by introducing the mass M estimated . This discrepancy can be very high.
The most famous example of this phenomenon is given by Qasar G 2237 + 0305 which is perfectly aligned with the galaxy ZW 2237 + 030 and the earth.
The Qasar is located at a distance of 8 billion light years from Earth, while the galaxy is "only" 400 million light years far.
The light that reaches the earth from the Qasar seems deflected by an angle much greater than that which would result from the application of (25). This suggests that this is due to a large amount of dark matter existings in the galaxy..
Our hypothesis allow to provide another explanation.
It appears that the Qasar is located about 14 billion light years from Earth, and not only 8.
In such conditions, the angle made by the light in the vicinity of the galaxy is greater than that estimated using only the (25)
There could therefore be agreement between the actual angle and the estimated one in (25).
And that without recourse to the hypothesis of dark matter.

Consequence N. 6 - Clusters of galaxies

It exists in the Universe regions where several galaxies are packed each in the vicinity of the others , so as to form veritable galaxy clusters. The reason why they are so close to each other is commonly attributed to the force of gravity which locally has obviously a big influence.

By considering , however, the total mass of these galaxy clusters one comes to the conclusion that the force of gravity is not enough to justify that their mutual proximity : in reality they should run away from each other under the influence of the expansion of the Universe .
The reason for this anomaly is commonly attributed , again, to the invisible presence of large amounts of dark matter that , with its mass, justifies a greater gravitational force, and then group them together.
Our hypothesis can provide a different explanation .
If we consider the formulas (13) and (15) we see that , according to our hypothesis (15) the force of gravity has increased with the expansion of the universe..
This justifies why galaxies do not move away from each other in the considered clusters. .

Consequence N. 7 - The Big Bang

Among the many oddities of modern physics, there is certainly the Big Bang, this singularity where was created something from nothing, including the laws of physics, matter and the notions of space and time, so you can not put the question of what existed before it.
This fact means that the Big Bang is presented as a concept of faith, a dogma, to which one must believe because all leads, for the moment, to conclude that things are going really in that way, but at the same time it makes us feel unconfortable in the sense that no reasoning can convince us that something can be engendered by nothing.
The Big Bang theory is today accomanieda by the so called inflationary universe.
This theory is developed mainly to explain the apparent uniformity of the universe in all its regions.
The hypothesis of A. Guth states that immediately after the initial instant of the Big Bang (when the universe was still smaller than a proton) the expansion has stopped very briefly so that the information could reach each region, so producing the uniformity, and then continued very fast for another short period of time (inflation, in fact), reaching values that we know today.
Let's say that, although now widely accepted in scientific circles, this theory seems a little too artificial and made to make ends meet ... just like the famous Einstein's cosmological constant ...

Our hypotheses can however shed new light on the subject.
Let us again consider the formula (6). We have seen that according to our hypothesis, to switch from the size of 1 meter to the current (estimated) of 10exp26 m took 864 billion years.
But it is clear that the universe is not certainly born with the dimensions of 1 meter. We can therefore imagine that it is born, as the classical hypothesis says, the size of a point, that is smaller of any size imaginable.

If, for example , we wanted start from the dimensions of 1 mm, the (6) tells us that the time necessary to reach the size of 1 m was of about 100 billion years. If instead we wanted to start with the dimensions of 1 micron, the time would be around 200 billion years.
If we want , at last , begin when, for example, the universe was the size of only 10exp-30 m, the time is of 1.03 trillion of years!
As you can see the process continues indefinitely: you come to the conclusion that **the beginning of the universe took place at a time infinitely far away!**
Although this introduces a new concept of infinity, this hypothesis seems more reasonable than the classical one. In fact, it eliminates the tantalizing question that we mentionned before: what existed before of 14 billion years ago?
The concept of infinity we are now a bit used, the dogmas, not!

Conclusions

In many human activities, such as safety, or when you should invest in a new endeavour, we use to make decisions using a parameter called in general as a risk. It is defined as the product of two factors:
The probability that the event can really happen.
The consequences of the realization of this event
Let us assume that our hypothesis has a probability of being true small or very small. However, the consequences would be rather amazing.
The product of two factors is then surely not zero.
We therefore believe that this hypothesis is worth considering.

APPENDIX

Parameters and basic variables

Among the large number of constants today known in nature, there are eight which are commonly regarded as fundamental quantities.
Taking into account their units, we report in the following these eight quantities and how they change with the time, following the expansion of the universe:

$c = 3x10^8\ m/\sec \quad speed\ of\ light \quad \cap e^{HT}$

$h = 1{,}05x10^{-27}\ erg\sec \quad Plank\ constant \quad \cap e^{2HT}$

$e = 4{,}8\,x10^{-10}\sqrt{erg}\,\sqrt{cm} \quad charge\ of\ electron \ \cap \sqrt{e^{3HT}}$

$m = 1{,}6\,x10^{-24}\ grams \qquad mass\ of\ proton\ = const$

$g = 1{,}4\,x10^{-49}\ erg\,cm^3 \quad Fermi\ constant\ for\ weak\ interactions\ \cap e^{5HT}$

$G = 6{,}7\,x10^{-8}\ erg\,cm\,gr^{-2}\ constant\ of\ gravity \ \cap e^{3HT}$

$H = 2{,}2\,x10^{-18}\sec^{-1}\ Hubble\ constant\ = const$

$\rho = 10^{-31}\ gr\,cm^{-3}\ average\,density\ of\ universe\ \cup e^{3HT}$

A very important consequence of our assumptions is that the previous quantities have maintained the same identical value , also if measured in the past.
Recall in fact the definition of erg

$erg = gr\,cm^2\sec^{-2}$

It therefore appears that, for example, Planck's constant, h, would have the same value of 1.05 x10exp -27 erg sec, also measured a billion years ago. The same is valid for the other 7 quantities.

With these eight constants one form five dimensionless ratios, which are of great importance in physics today:

$\alpha = e^2/hc = 7{,}3x10^{-3}\ \ constant\ of\ \ fine\ structure$

$\beta = gm^2c/h^3 = 9x10^{-6}$

$\gamma = Gm^2/hc = 5x10^{-39}$

$\delta = Hh/mc^2 = 10^{-42}$

$\varepsilon = G\rho/H^2 = 2x10^{-3}$

In the scientific world, there is a common agreement that they must be considered constant over time: i.e., they have kept strictly to their present value since the Big Bang to today.
Any (also small) variation of one of these ratios with the time, would simply not have permitted to the universe to evolute such as we see it today.
As one can see, our hypothesis perfectly permits to fulfill this requirement: the five ratios are constant and independent from time.