The theory of electromagnetic field motion. 12. To the Big Bang theory

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On the basis of existence of electromagnetic ether (dark energy) the process of Universe expansion usually named as Big Bang is considered in the paper. It is shown that observable Universe instead of really existing at present moment must be used as a basis of the Universe model. Using spherical Universe approximation the modified model is proposed taking into account time dilation of gravitational nature occurred in the past. It is noted that time dilation in the past is responsible for red shift of remote galaxies. On the basis of the model proposed it is shown that in non-central position of our Galaxy in the Universe the observable Universe must be anisotropic. The empirical time equation of the Universe as exponential dependence Universe intrinsic time on current time is proposed. The assumption is proved that the Universe age is cosmological constant which does not change or changes very slowly. Using time equation as a basis it is shown that expansion of the Universe in units of intrinsic time has started infinitely long ago and proceeds now at permanently increasing speed.

12.1. Introduction

Now the Universe is generally accepted to be originated from Big Bang. The Big Bang cosmological model successfully explains number of observable phenomena. This model really explains large number of phenomena, but there are exceptions. Let`s select those of them for which we hope to find at least partial explanation within the scope of present work.

1. The physical reasons of red shift i.e. shift of spectral lines of chemical elements from remote galaxies to the red (long-wave) part are unknown. Doppler effect in recession of galaxies is seen to explain this shift. Such an explanation contradicts conclusions of the special theory of relativity (STR) since velocity of space objects must reach and exceed velocity of light. The solution to the problem is usually found by the statement (we do not know who has priority) that on such big distances physics laws do not comply with STR conclusion. This is correct conclusion as it will be shown below, but additional substantiation is needed.

2. On the basis of observation the conclusion is made that the Universe extends at acceleration. The explanation of the physical reasons of such acceleration does not exist.

3. Unresolved problem of the Big Bang theory is the existence of the initial moment of origination of the Universe when the Universe is in singular state. On the one hand, if initial moment of Big Bang existed something must also exist prior to it. On the other hand, anything could not exist before Big Bang. The problem would not exist if Big Bang has occurred infinitely long ago, but observations proved that the Big Bang has occurred about 13,8 billion years ago. To solve this contradiction the assumption is proposed that the space and time have arisen at the moment of Big Bang.

4. According to cosmologic principle, the Universe must be homogeneous and isotropic. However observations resulted in increasing quantity of facts about small in value, but statistically significant heterogeneity and anisotropy of the Universe. There are no any convincing explanations to this fact.

5. Astronomical observations lead to a conclusion about existence of dark energy. However, the physical essence of this energy is unknown, if to exclude from consideration results of our work [1], which itself need an additional substantiation.

6. In the past, after a Big Bang, the matter density and electromagnetic ether energy density (dark energy) were essentially higher than that at present time. Therefore gravitational effects must become substantial: gravitational reduction in length, time and velocity of light, but these effects are not considered in any way in cosmology models. Last effect, Shapiro effect [2], is less known in comparison with the first two, it will play special role for us in constructing Universe model. Gravitational decrease in velocity of light follows from the equations of the general theory of relativity (GTR), but it can be shown by means of simple and evident reasonings.

From the GTR viewpoint, the remote observer measures passed distance near to the gravitating mass by means of a ruler which is at the same point, with the ruler is light itself. The remote observer measures time by means of its clock, i.e. far from gravitational field. The observer who is in the local frame of reference in gravitational field does not detect any decrease in velocity of light because his clock show smaller time.

From the viewpoint of electromagnetic ether theory, light, passing through area near to the gravitating mass, passes through the area of increased energy density and, hence, through the area of higher optical density and, hence, its velocity is reduced.

Difficulties of cosmologic Big Bang model presented above are caused in essential degree by the absence of enough satisfactory physical

(geometrical) model of the Universe considering properties of dark energy, electromagnetic ether. Development of such a model and research of consequences to follow is just the purpose of the present work.

12.2. The observable Universe

Simplest spherical model of the Universe actually exist in the form of an inflated balloon. Such a model allows explain why the expanding Universe has no specific centre in relation to which expansion proceeds. Let`s consider advantages and disadvantages of classical model.

The classical model in the form of an inflated sphere allows come from three-dimensional closed space which cannot be represented on paper sheet or imagined, to two-dimensional closed one that is the sphere surface. Mathematically to come to the three-dimensional closed space it is enough to add to the equation describing two-dimensional space the term including third coordinate. In such an approach advantages of mathematical and image thinking are combined.

Disadvantage of classical model is that the time is completely lost and there is nothing to mention the time. The sphere surface is supposed to be uniformly filled by galaxies. It is valid for the real Universe that really existing at present moment, but does not concern the observable Universe where remote galaxies at the moment does not exist anymore or, anyway, they have been strongly changed and located at other position.

Let's distinguish the real and observable Universe. According to modern views real Universe on the big distances on the average is the same as that close to our Galaxy, but its specific view will be known only in future.

It should be noted that from the viewpoint of geometrical optics the real Universe represents a sphere filled with electromagnetic ether (dark energy) with total internal reflection at the borders, because beyond the sphere ether density is equal to zero and, hence, velocity of light tends to infinity. Certainly, the real Universe is not reduced to such a sphere because, firstly, at the sphere border not only velocity of light but also rate of current time changes, and, secondly, such a model does not considers time at all.

Let's specify concept of the observable Universe that we use later. Unlike real, the observable Universe can be observed at present moment only. It narrows in some extent the concept of the observable Universe in comparison with that accepted in cosmology, but we apply it in this narrow sense. At present time only the observable Universe has effect on events that is *observed* at present moment of local time.

From such viewpoint the local observer does not interest what occurs in the real Universe at present moment. Even if the next star has blown up, the observer will get to know about it in some years at the best, and only then this event can influence current life.

If we observe the nebula resulted from star explosion we can assert by the results observed that the star has blown up in the past, but the event of explosion itself does not relates to the observable Universe in our narrow sense; the nebula which has remained at present time after explosion relates to the observable Universe.

In Minkowski space the observable Universe represents a surface (and only a surface) of light cone faced to the past by its basis.

12.3. Spherical model of the observable Universe

Simple spherical model of the observable Universe is easily obtained from classical model in the form of inflatable rubber ball. As is shown in fig 12.1, the model of the observable Universe also represents inflated sphere. For the sake of clarity let`s imagine that it is the inflated rubber globe.

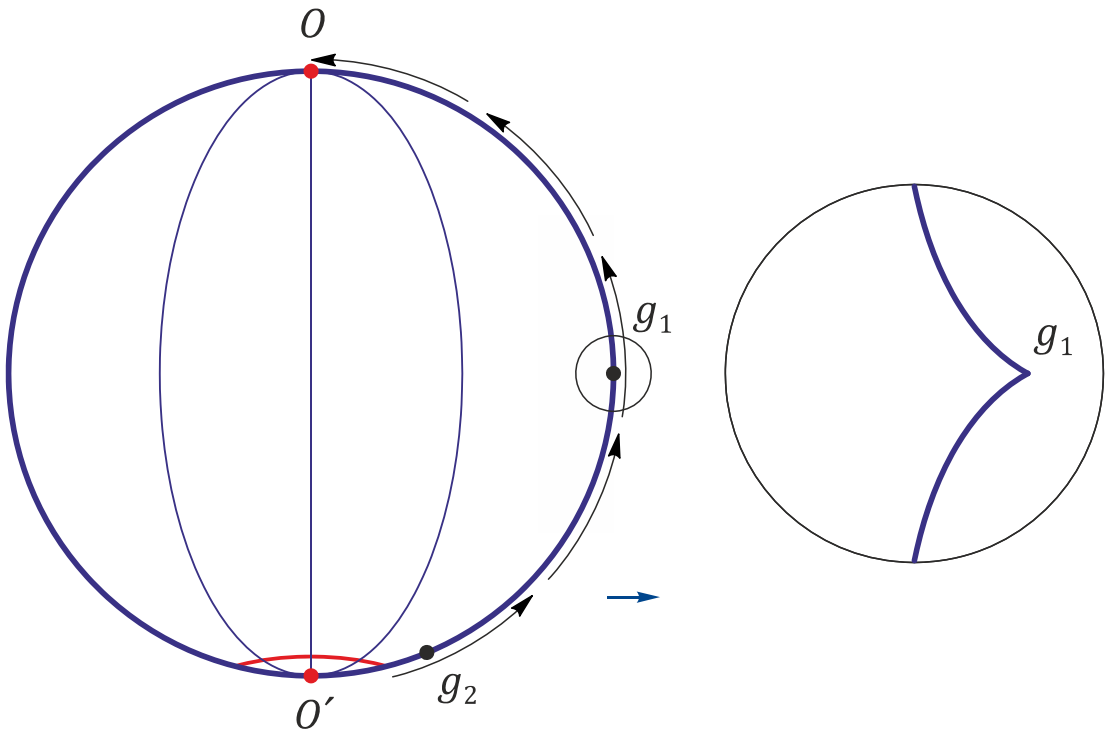

Fig. 12.1. Spherical model of the observable Universe

The observer who is on «northern pole» at point O, sees galaxies: rather close g_1 and remote galaxy g_2. The red arch, «coast of Antarctica», corresponds to the border beyond which there are no astronomical objects that could be observed. The exception is the relic radiation which propagates from the areas which are in depth of "Antarctica". At the point O' there is singularity existing at the moment of a Big Bang, but light from it does not reach us by known reasons.

Light propagates from the past to the present (at point O) on a sphere surface only along direct (geodetic) lines which are considered to be meridians. In other directions light simply does not reach the observer at point O, it passes by. Light direction in fig. 12.1 is shown by arrows at sphere surface. In the opposite direction it naturally cannot propagate: it would mean light propagation from the present to the past.

Since the velocity of light is constant value, as we believe within the limits of this model, the length of arch along meridian means both the distance expressed in light units of length and the time numerically equal to that necessary for light to overcome this distance.

Such spherical model of the Universe is based on application of the units of length, time and velocity of light existing at the observation moment in point O. This model reflects some of the basic properties of the observable Universe well enough, it can be used for further development to display adequately as much as possible the properties of actually existing observable Universe.

However such spherical model of the Universe has one essential disadvantage. We said above that the length of an arch of meridian at constant velocity of light means time necessary for light to overcome this length of the arch. However so happens not always. If, for example, a galaxy g_1 is on way of light passing from a galaxy g_2 to point O (fig. 12.1) the light change its propagation direction when passing g_1 moving around a galaxy g_1 due to lens effect in the general theory of a relativity, but this in any way cannot be displayed in the figure.

The way out can be found, if arch length be made proportional not to the time necessary for light to overcome certain path, but to the optical path length. We remind that the optical path length in our case is a distance light would cover for time necessary to overcome gravitational disturbance in the absence of gravitational disturbance itself. Optical path length is the concept of classical physics, however its application to the description of STR in our case is quite justified because only using this concept it is possible to explain rounding the obstacle such as a galaxy by light from

classical positions: light, moving around a galaxy, selects optically shortest and, hence, the most quick way.

Then passage galaxy g_1 by light can be displayed as convexity on arch displaying time, Og_1g_2O', as it is shown in an enlarged view inside the circle near point g_1 (convexity form is conditional). The convexity is caused by increase in optical path length through galaxy and formed due to decrease in velocity of light when passing galaxy owing to higher energy density of electromagnetic ether (dark energy) in comparison with that of surrounding space. High density is due to gravitational concentration of surrounding intergalactic ether, and also additional ether (dark energy) generated by stars, collapsars and other galaxy gravitating objects.

The collapsar in the galaxy centre in such drawing could be represented by exclusively thin needle which has not been shown in figure because we are interested only in general contribution of the collapsar to the total density of ether (dark energy), instead of its image in model under consideration.

12.4. Universe model considering time dilation in the past

Let's consider some properties of the Universe following from described modified spherical model of the observable Universe in which optical path length is directed along meridians.

What means the fact of Universe expansion on the basis of presented model? It means that the electromagnetic ether (dark energy) density decreases due to expansion. Basic contribution in ether density brings initially existing electromagnetic intergalactic ether. Hypothetical intergalactic dark matter probably also brings its own contribution. The part brought by galaxies in the total contribution to intergalactic ether (dark energy) is rather negative than positive.

On the one hand, all substance of galaxy and ether cloud (dark energy), surrounding a galaxy, bring the contribution to average value of the intergalactic ether; all that taken together create gravitational field. But the gravitational field quickly decreases and its contribution is rather insignificant.

On the other hand, there is condensation of intergalactic electromagnetic ether (dark energy) around galaxies. This condensation is caused by gravitational forces. Ether clouds were formed initially. At early stages of Universe development all substance was condensed off the clouds

from which then galaxies emerged. Owing to the various initial sizes and concentration of primary cloud the galaxies with various relation between substance and ether cloud masses are now observed. Clouds of low concentration without galaxy in the centre are possible to exist. On the other hand, if there were a number of such clouds, distant astronomical objects would lose clearness. It is not observed, but nevertheless such clouds must exist.

Continuous condensation of ether (dark energy) leads to reduction in energy density of intergalactic ether. This leads in turn to increase in sizes of all bodies and distances between them with time, as it occurs in moving away from gravitating object of big mass when also there should be a reduction in energy density of electromagnetic ether according to GTR. Galaxies will move away from each other at velocity which increases with distance between them. It should be underlined that this movement is not related to galaxy kinetic energy, because each of the galaxies remains motionless in relation to surrounding space or, what is the same, to electromagnetic ether. Space itself is extended, the lesser ether density, the larger distance between objects. Rate of such an expansion may exceed velocity of light many times because it is not accompanied by increase in kinetic energy and, hence, does not submit to STR laws.

Let's return to our model. The larger distance between galaxy and observation point *O*, the higher ether density (dark energy) at the moment of light emission, and, hence, higher gravitational red shift occured. Red shift of galaxies has nothing to Doppler effect, this is purely gravitational effect. Accordingly, Hubble sphere, at which galaxy velocity calculated on the basis of Doppler effect reaches velocity of light, has no physical interpretation.

Let's notice that with growth distance to the galaxy due to gravitational delay in velocity of light in relation to the observer at point *O* the optical path length increases, and it is necessary to increase meridian length in the model. In such an increase meridian piece length will display not only optical path length but also intrinsic time of galaxy since optical path we express in light years as has been done in spherical model. When approaching point *O´* the meridian length increases infinitely as shown in fig. 12.2*a*.

Designations are the same as in fig. 12.1. Initial sphere is shown by dotted line the.

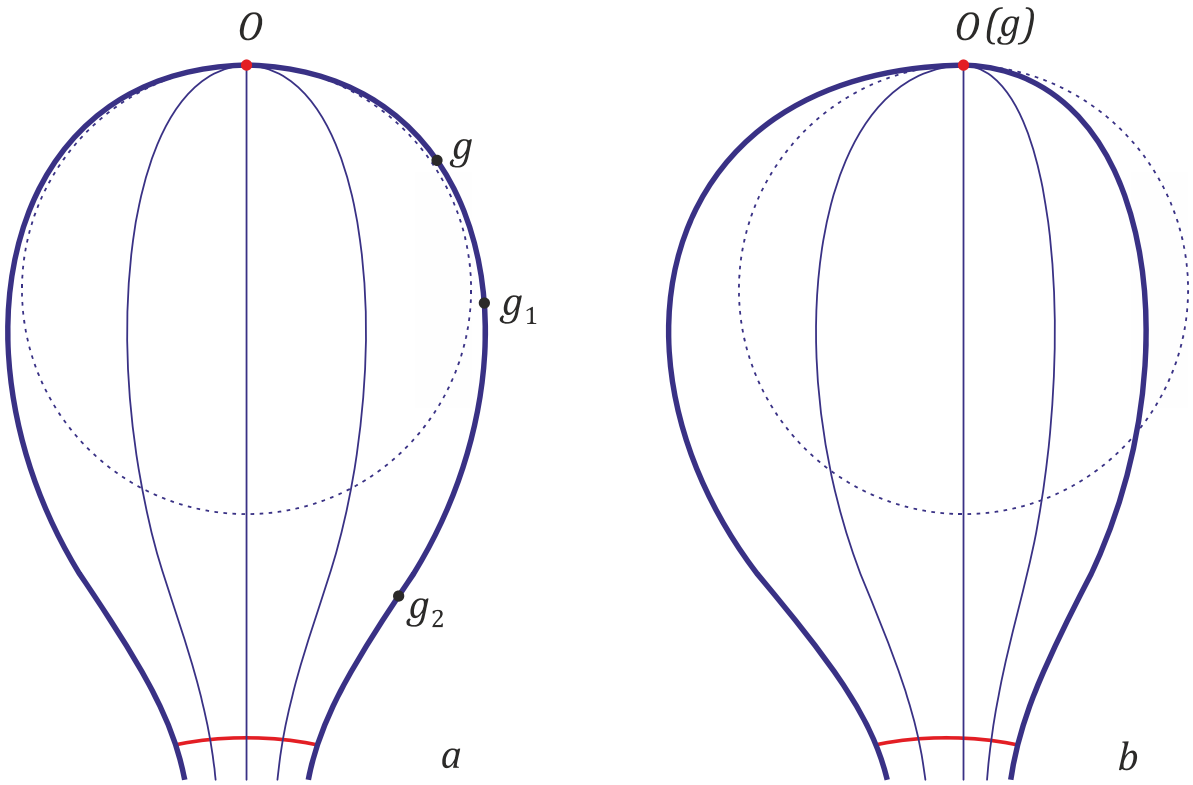

Fig. 12.2. Model of the Universe taking into account time dilation in the past
a - the observer is located at the Universe centre;
b - the observer is displaced in relation to the centre.

What make the models different from each other? The basic difference between them consists in that the models are based on usage of different concepts of time. In spherical model time at point *O* is used which we will designate further by letter *t*, i.e. this is usual current time at observation point *O*. Delayed time which must be observed by the observer located at the point *O*, at any other point, for example at g_1, we name as intrinsic time at corresponding point and designate it by letter τ. It should be noted that if observer really was at the point g_1, he would not notice any delay in time, as follows from GTR. As regard to the observer at point *O*, he find out gravitational shift of chemical element spectral lines to the red area owing to time dilation as it is shown in [3] by consideration of gravitational time dilation, and, thus, he cannot ignore time dilation at the points other than point *O*.

Thus, red shift of galaxies is caused by gravitational time dilation in remote galaxies. Visible gravitational reduction in sizes of remote galaxies

also must be observed, i.e. remote galaxies when observed will be seemed less than the nearest ones.

The observer in fig. 12.2*a* is in the Universe centre at point *O*. This point corresponds to the present time and is at the top of the intrinsic time curve drawn to the bottom. All other points of the curve are in the past and, hence, are located below point *O*. What happen if the observer moves from point *O*, for example, to the point *g*? We need not move to the point *g* that is not strictly at the Universe centre but little aside if you initially are located at this point. Such displacement, possibly, relates also to our Galaxy, it is difficult to expect that we are strictly at the Universe centre. Then the curve of optical path length will be asymmetric what represented in fig. 12.2*b*. The observer is still at the point *O (g)* of the curve top whereas other points are in the past. Anisotropy of the observable Universe is due to such asymmetric arrangement.

Enhanced concentration of galaxies will be observed along the left branch of the curve (fig. 12.2*b)* that is larger than right branch, whereas intensity of relic radiation will be less than in opposite direction.

Other kinds of anisotropy besides specified are not excluded, however their sources are not so obvious.

12.5. Universe intrinsic time

We have noticed above that the meridian length is proportional to the time run, and increases infinitely when removal from point *O* and approaching to point *O´*. It is caused by gravitational time dilation because mass density including both substance, and ether (dark energy), increases infinitely in approaching to the point *O´*; besides infinitely big mass (presumably) of the latent part of the Universe is concentrated at the point *O´*. Let`s try to find an analytical view of this length using designations entered earlier: t is the current time at point *O* and τ is the intrinsic time. Time t in "sphere inflating» changes from 0 at the Big Bang till present time $t_0 \approx 13{,}8$ billion years and is defined by the observer, the our contemporary by means of his clock. Time in the past is defined by extrapolation to the past. It is now occurs in time estimation in the past. Time τ is directly measured by means of own clock by the observer, the witness of all processes, beginning from Big Bang till now.

Time equation must be represented by rapidly increasing function that corresponds to the Universe extending with acceleration, and the derivative $dt/d\tau$ must be equal to 1 at point t_0 since at this point time

current rates t and τ coincide at present moment (clock are at the same time at the same point).

Exponential function meets to these conditions:

$$t = t_0 e^{\tau/t_0}. \qquad (12.1)$$

Fig. 12.3 shows graphic view of time equation (12.1) (a red curve). A dark blue straight line is the tangent line to the exponent at point (0; t_0).

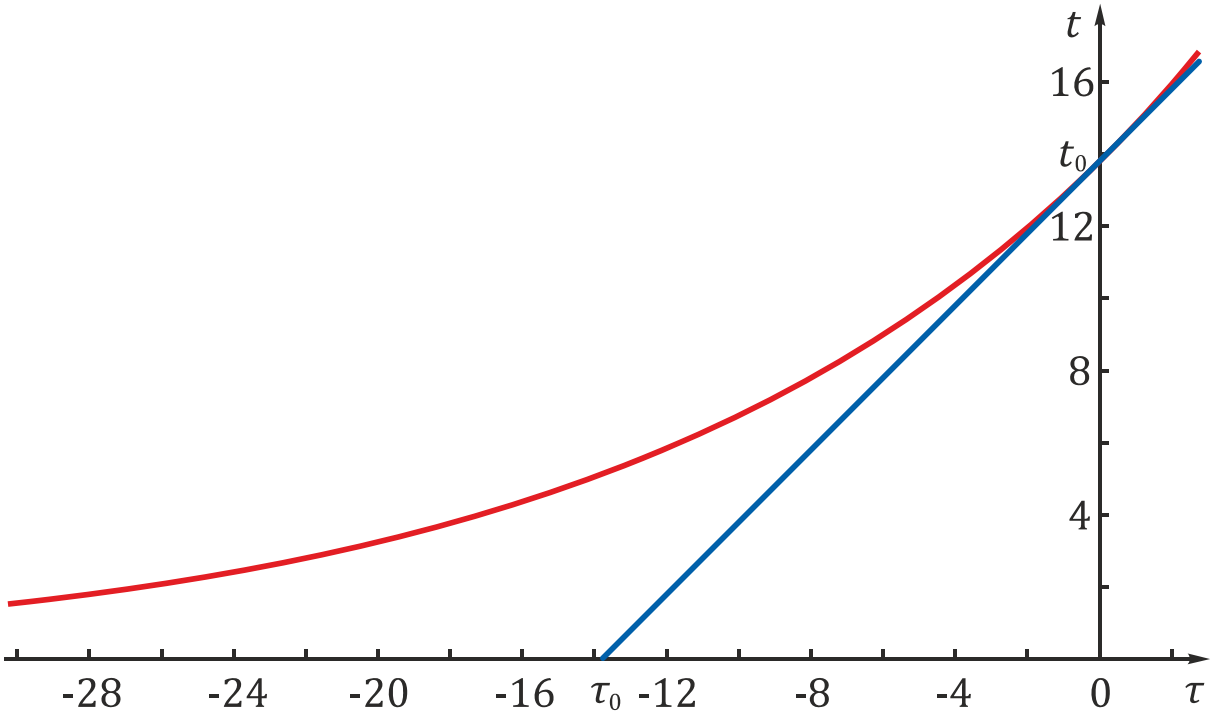

Fig. 12.3. Dependence of current time t on Universe intrinsic time τ
Time unit on axes of t and τ is billion year, $t_0 \approx 13{,}8 \cdot 10^9$ years.

Modern cosmology considers only single time, the current time, and current time rate is supposed to be the same both in the past and at present moment. Let`s consider how it can be interpreted using time equation taking into account existence of Universe intrinsic time (12.1).

Rates of current time t and intrinsic time τ at point (0; t_0) are equal. This dependence can be approximated with the great accuracy by straight line crossing time axis t at angle 45^0 in vicinity of the point (0; t_0). By extrapolating this straight line before crossing the axis τ, i.e. considering that current time rate is invariable, we obtain intrinsic time value $\tau_0 = t_0$.

This time moment was considered to be the Big Bang moment and time count has started here, and it also generates the question what happened before.

The term "Big Bang" is in this respect extremely unsuccessful. It generates illusion of the beginning of explosion (what happened earlier?) and illusion that galaxies fly away after explosion under its own inertia, and, hence, without acceleration. Term «Big expansion» would be more successful. In fact, the Universe has arisen infinitely long time ago, as appears from (12.1), and since then continuously extends with acceleration. Expansion rate can be found by differentiating time equation (12.1):

$$\frac{dt}{d\tau} = e^{\tau/t_0}. \qquad (12.2)$$

As follows from (12.2), rate of current time increase which we obtain by astronomical observation exponentially falls as deepening in the past. Hence, rate of Universe expansion also decreases (it becomes more evident if time and distance are measured in light years). On initial part of the exponent near to the present time there is a small difference from straight line, therefore, considering the big error of measurements and peculiar velocity of galaxies, dilation in Universe expansion is hardly be noted. But for the most remote galaxies accessible for observation decrease of their acceleration when removal in the past can`t be neglected what allows to draw a conclusion that Universe expansion rate increases with time.

Solving the equation (12.1) for intrinsic time τ, we obtain:

$$\tau = t_0 \ln\frac{t}{t_0}. \qquad (12.3)$$

All major the most ancient stages in Universe development are usually timed beginning from the Big Bang moment, i.e. it expressed in terms of current time *t*. Expression (12.3) allows to convert current time *t* into intrinsic time τ. We take as an example relic radiation age. Let`s suppose as an example the age of relic radiation. If relic radiation formation time is supposed to be 400000 years, i.e. approximately $13{,}4 \cdot 10^9$ years ago, we obtain from (12.3) the intrinsic time τ equal to $143{,}8 \cdot 10^9$

years ago, i.e. the age of relic radiation in units of intrinsic time is more than by order exceeds the age expressed in units of current time.

Let's compare the modern observable Universe to the observable Universe that it was 2-3 billion years ago. If we could make such comparison it would be seen that the Universe has not changed too strongly: the same galaxies, even their relative size practically has not changed. So the old Universe and the new altered one are similar to each other. They considerably differ from each other only by energy density of intergalactic ether (dark energy). In this case it is inappropriate to speak about gravitational potential since in Universe scales, unlike local systems, this concept, obviously, is essentially inapplicable.

In both Universes, both ancient and modern, physics laws are equally effective and cosmological constants have the same values (anyway approximately). Such a situation is also valid for local systems which are in various gravitational fields. The Universe is entirely nonlocal system however conclusion on invariance of the physical laws must be valid also for local systems as follows from GTR.

Since physics laws and cosmological constants are identical, results of astronomical observations (red shift and other observations) will lead to the same conclusions about Universe age which is near 13,8 billion years. In other respects the ancient Universe, certainly, will look a little younger in comparison with modern one, all processes accompanying Big Bang will start and finished later, closer to the time of observation.

Let's assume that the observer has made during that far epoch the graph similar to that represented in fig. 12.3 for the Universe. Since the age of the Universe t_0 has not changed, the curve would be obtained that completely coincides with that represented in fig. 12.3. From here it is possible to draw a conclusion that t_0 is cosmological constant. If t_0 is determined by electromagnetic ether condensation rate, as has been pointed earlier, t_0 is approximate constant because condensation rate can be approximate constant only, what probably concerns also some other cosmological constants.

The time equation 12.1 is purely empirical, generalizing the known experimental facts. Therefore without careful astronomical observations and analysis of the results obtained it is impossible to make a conclusion about equation accuracy. In this respect the major role could play careful measurements of acceleration of Universe expansion and hence checking the correctness of the equation 12.2.

12.6. Conclusion

Let's consider what`s new indeed the present paper has done.

Instead of considering the real-life Universe which is inaccessible to observe and becomes accessible only in the future, we have used as a base the observable Universe that is observed at instant time. This has allowed developing Universe spherical model in which length of an arch is proportional to the way passed by light from the past to the present, or to the current time necessary to overcome this way.

On the basis of spherical model with gravitational time dilation and decrease in velocity of light taken into account the new model has been developed in the form of sphere deformed and extended into infinite past. The length of an arch of the deformed sphere in this case is proportional to the optical path length or Universe intrinsic time. The past is characterized by high electromagnetic ether energy density (dark energy) similar to that in the nearest vicinities of very big gravitating mass (inside very big gravitating body is better to say). Gravitational time delay explains in this case red shift of remote galaxies and low velocity of light observed in the past from the viewpoint of the modern observer.

Big Bang overall picture looks as follows.

The Universe has arisen infinitely long ago in units of intrinsic time (or always existed, what is the same) and started to extend with acceleration from the moment of occurrence. Universe intrinsic time is thus described by the equation (12.1) and is determined by the clock of observer who was present at the birth of the Universe and its following expansion. This expansion proceeds till now and will proceed in the future. The observer during expansion (Big Bang) fixes all its stages, leaving them in the past. Simultaneously, based on his own observations using current time and by extrapolating them in the past, the observer will come to a conclusion that the expansion (Big Bang) has started ~13,8 billion years ago.

Universe expansion will proceed also in future with increasing rate according to the time equation (12.1) provided that observations confirm its validity. Further and further in the past Big Bang stages will move away, but current time from the moment of the big explosion will remain equal to ~13,8 billion years.

Summary

1. It is shown that Universe model must be based upon the observable Universe, not real one.

2. Proposed spherical model of the observable Universe is in good agreement with picture of the observable Universe if time units coinciding with modern current time rate are used. It is shown that the electromagnetic ether energy density (dark energy) in the past exceeds modern value increasing as moving off in the past.

3. The increase in electromagnetic ether energy density causes gravitational time dilation in the past and, as consequence, permanently increasing red shift of remote galaxies.

4. The spherical model of the observable Universe was modified taking into account time dilation. The optical path length instead geometrical path and intrinsic time instead of current time were put into basis of the modified model.

5. The observable Universe was shown to be isotropic in the case of central position of our Galaxy in the Universe, in the case of its displacement from the centre the anisotropy of galaxy density and relic radiation intensity must be observed.

6. Empirical time equation of the Universe has been proposed. Time equation shows that expansion of the Universe in units of intrinsic time has started infinitely long time ago and proceeds now with increasing rate. Age of the Universe which is equal to ~13,8 billion years in current time units is cosmological constant and does not change or changes very slowly.

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