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About Physical Foundations of Some Contemporary Paradigms

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Abstract

We apply the early developed analytic approach which was used to model the macroplastic deformation of polycrystalline solids, for analysis of evolution of our visible Universe. Such evolution was considered as grand non-stationary stochastic process providing transferring the energy of the Big Bang in space. As consequences of the first and second laws of thermodynamics necessities were shown, respectively, to endless existence of life phenomena in the Universe as a form of the energy transferring together with – conservation of individual life for each living creature to provide spatial homogeneity conservation for the transferring. Proceeding from the spherical symmetry of the Big Bang products distribution and the principally limited time period of the Big Bang development, spherical ring structure of the whole Universe was proposed. Based on the structure, two possible variants of the material objects motion within the whole Universe was considered: 1) - practically free of interactions with the other products, motion in radial directions; 2) – strongly affected by the interaction the curved trajectories motion. Calculated percentages for the contributions in the energy flux for the various types of elementary particles as the energy carriers are in accordance with the known contents of the baryonic, Dark matters and Dark energy in the visible Universe. Early predicted countless number of the approach constitutive equation solutions were associated with the corresponding number of the energy carriers and the mono-universes. A mechanism for participating the mono-universes in the expansion of the whole, poly-universe was proposed. The observed non-monotonic time dependence for the speed of our visible mono-universe expansion is in accordance with the approach predictions.

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Time dependencies of the square density of the energy carriers and the stress caused the Big Bang energy gradient were calculated and their reciprocal mutual dependence was shown at finishing stage of the visible Universe evolution, in accordance with the known Chaplygin gas models.

Key words: paradigms; non-stationary stochastic processes; Big Bang; baryonic and Dark matters; Dark energy; Universe evolution; Chaplygin gas.

1. Introduction

As it well known, one of definition of a paradigm is a set of notions and approaches which are in common and widest use in a branch of human intellectual activity: science, culture, religion etc. It is also of overall acceptance that we, the other living creatures and all things around us are components of our visible Universe, where all possible phenomena appear and processes develop. All objects in the Universe obeyed common for them or "nature" laws defining the fundamental rules together with some specific features of their behavior. For centuries the above notions correspond separation of humans having unique intelligence compared with the rest Universe and constantly trying to create a logically perfect picture of the surrounding nature. Meantime, during the human history there were the other rational constructions (scientific, philosophical) propagating the other ideas. It was expressed in racing various religion and philosophic currents the true of which cannot be directly proven experimentally. Nevertheless, the history of human civilizations shows that namely the people ideas about surrounding world as objectively, independently of the humans existing object are the most stimulated factors of the civilizations development [1]. The history also shows that driving force of the developments was scientific investigations and their achievements. Such investigations were practically conducted based on the analogies of various nature phenomena. This principle is used at a time in fact not only in mathematics [2], but in the other branches [3] of science and is confirmed by numerous experimental facts. As an example, the phase transformations in crystalline solids and the plastic deformation of the solids [4, 17] may be considered. Besides, the principle of analogy of various natural phenomena and processes is a foundation of such modern field of cybernetics as artificial intelligence, functioning of which is based on the preliminary learning some typical, well known phenomena, formulation of stable rules and further using them to describe novel phenomena. Due to absence of commonly accepted criterion for workability evaluation for the analogy principle, effective working of the analogies in scientific investigations, probably should be measured by the results of their predictions and practical applications.

Besides, there are open discussions about the requirements of practically all known religions regarding enforcing the high moral norms, saving living conditions for all living creatures, forecasting alternatively the fate of the Universe. The same may be said about trends to enlarge the human and other living creatures lifes etc., that is expressed at our times by the efforts for the industry sustainable development, increased attention to improve medical care etc. Meantime, numerous and intensive investigations are now been conducting concerned with our Universe evolution [5–8]. However, the most of the investigations do not proceed from basic principles common for wide variety of natural phenomena and are begun from some intermediate but relevant conditions such as "Chaplygin gas" based models. Additionally, there are also scientifically unresolved problems related to possibility of existence of numerous Universes [9], back in time travelling etc.

In some recent researches [10-12] high effectiveness of the investigation approach based on analytic consideration of the plastic deformation of FCC policrystals as a non-stationary stochastic process (NSP) was shown. As may be seen from the works, the approach is directly grounded on some commonly accepted notions of the dislocation theory [13], theory of random processes [14], linear stability analysis for real solutions of a non-linear differential equation [14]. Based on the high adequacy of the calculated within the approach frame stress - strain curves with the experimental ones for the FCC polycrystals, it was concluded [15] a possibility to expand the approach to the other NSP analysis.

2. Physical confirmation of some modern paradigms

Based on the physical definition of a NSP as such a process which has characteristic time moments of its beginning and finishing together with the analogy principle [3], let's consider a possibility of quantitative analysis some basic features of our Universe evolution within the frame of the above mentioned, early proposed analytic approach [10-12]. The ground of the attempt is the above mentioned close analogy of all NSPs with each other, together with fundamental cosmology concept about appearance of the Big Bang [6]. Besides, the macro-plastic deformation process may be considered as an analog of the Universe evolution as during the latter NSP an energy is probably carried by the "strings" [16] which may be analogous to the line crystal lattice defects or dislocations.

Before we proceed, it should be noted that the most notions related to the Universe evolution are very restricted in their verification by the direct experiments, that is why as the truth criterion during indirect comparison of a model developed with the experimental data having been known by the time, the coincidence of the model predictions with as more as possible known experimental data and theoretical notions should be probably taken into account.

Proceeding from the above, we shall use further the well known features of the behavior of a typical free explosion which is happened really in a space "point". Probably the main characteristic features of the explosion are: theoretical conservation of the full original amount of the explosion energy, gradual transformation of the original form of the energy into other ones, such as creation of new material objects (explosion products), kinetic energy of their motion, potential energy of their interactions etc. Among the features it is also the next, very important one: uniform distribution of the original amount of the energy in any possible directions, of course, under the condition, of the uniform transport properties of the explosion surroundings near its epicenter.

Under the context of the Universe evolution, it is natural, obviously to suppose full obeying the above basic conditions, especially: conservation of the Big Bang energy together with its uniform distribution after the Big Bang appearance. It should be noted the supporting the just formulated assumptions by all available cosmological data [5-9]. Taking into account the non-stationary stochastic character of the Universe evolution process, in general, which we shall reference to as ***grand NSP***. Meantime, its components connected with transferring various forms of the Big Bang energy, we shall consider as ***local NSPs***.

So, proceeding from the above, we may conclude that such NSP as the Universe evolution, or grand NSP, cannot be fully, definitively finished, or disappear. Meantime, any local NSP may disappear in one point of the Universe, but - have to start at the same point but at a time determined by the Heizenberg uncertainty relation for an energy and time. As examples of such local NSPs the known transformations of elementary particles may be considered.

Evidently that a human or any other living creature in nature is also a carrier of an energy and information initially generated by the Bib Bang or a participant of a local NSP. That is why, conservation of an original homogeneous distribution of the energy or the original level of the entropy, has to be provided by means of conservation of every human or another living creature's life.

So, destroying the life in general in the Universe contradicts to one of the basic law of nature, conservation of energy law and finally leads to a fate of the whole Universe. Additionally, the full destroying individual life of a human or another living creature without possibility of the multiplication, contradicts the law of conservation or increasing an initial disordering level of the Universe or second law of thermodynamics. So, these consequences of the fundamental laws of nature, may be considered as a foundation of the well known moral and contemporary ecological requirements or the corresponding paradigms.

2.1. Possible variants of the universe components motion

In addition to the above, it should be emphasized that the Big Bang explosion products have to be arranged uniformly with radial symmetry that, together with mandatory existence of the explosion start and finishing times, allows to imaging our Universe as spherical "layer" which is limited by spheres corresponding the above moments of time.Hence, two possible variants (regimes) of energy (information) exchange within the whole Universe by means of material objects motion should be considered.

One of the transferring energy regime may develop by a motion of an energy material carrier from a point located within the layer of the Big Bang product in approximately radial direction (along a straight line) as, for example, - back to the epicentre of the Big Bang (or to the past), as - to the out of the layer (to the future of the Universe evolution). During such a motion, a material energy carrier has to cross some "spheres" which correspond, respectively, to the earlier and latter appeared material objects and relevant local NSPs development during the Universe evolution. Evidently that such a motion corresponds to the reverse traveling in time.

On the other hand the same material energy carrier can move only within some narrow area (along a curved or approximately circle trajectory) along with the other material objects created practically simultaneously with the considered one, which carries the Big Bang energy. Such type of the object motion develops exclusively along some very closely located spherical surfaces each of them corresponds to different but very close to each other moments of time.

Evidently that the both considered above the energy carrier motion variants (regimes) allow as straightforward as backward traveling in time. However, the motion velocity for the regimes have to be different [11,15]. Namely, the first considered motion mechanism develops by passing very large distances along a straight line in

a radial direction due to the action of the external energy gradient providing overcoming all existing obstacles [10-12]. It means relatively weak stopping effects of an interaction of the moving object with the other Big Bang products compared with the large external force values. So, this motion variant may be considered as a high speed, non-diffusive or "military" one, by analogy with the well known military phase transformations in crystalline solids [4]. It is also analogous to the wave propagation in the space filled in numerous material objects.

Meantime, the second motion regime can develop only along a curved or part-of-a"circle" trajectory and requires a helping interaction with the other material products of the Big Bang [10,11,15] to develop. Evidently, that during the motion the resistance has to be overcome from some of the Big Bang products. So, one may conclude that such motion regime is analogous to the "diffusion" process that is also known as "civilian" phase transformation in crystalline solids [4] which proceeds under the conditions of weak "driving" force (external energy gradient) but mainly– due to the interactions between crystal atoms. The both above conclusions are in agreement with results of the early developed analytic model [10-12], namely – with the relations defining the numerical values of the relevant model constants.

It should be noted here, that described above differences between the two possible regimes of the Big Bang energy carriers motion may be observed under the condition of big distances between starting and finishing motion points. As it follows from the geometrical consideration, the trajectories, corresponding to the above discussed two motion regimes are practically indistinguishable together with all their characteristics under the small distances between the limiting points. It means that separable effects of the two motion regimes, namely; development only the first or the second one, may be detected under the conditions of large distances between the considered interacting material objects. In alternative case or under the condition of small separating distances, the both above energy carriers motion mechanisms have to develop simultaneously and with close contributions to the NSP. It should be emphasized that just given conclusions are in good accordance with well known experimental data concerned with wave – particle duality for the objects having small sizes and therefore able to be located at small separating distances. On the other hand, for the case of the macroscopic objects arranged on relatively big distances the no duality is observed.

The other conclusions regarding the Universe evolution may be formulated based directly on the early developed general analytic model [10-12,15]. At first, it is necessary to pay attention to a possibility for development of unlimited number, countless NSPs during the Universe evolution [11,15], that has to provide a combination of non-periodic and periodic changes of various possible evolution phenomena. Such a possibility flows from existence of countless solutions of the constitutive equation of the analytic approach [10-12,15]. The corresponding trajectories begin to evolve at various time moments, are fully real and correspond to appearance of novel energy carriers, states of which may unpredictably change periodically and non-periodically in time. Such trajectories should be considered as corresponding to the evolution of various material objects inside single visible Universe which start in various spatial points and successively occupy full volume of such a Universe. The above results are also in accordance with the experimental data showing oscillations of the elementary particles [18].

In addition, according to [12,15], the above fully identical, countless trajectories may be also considered as corresponding to the combined non-periodic and periodic motion of own energy carriers in various universes (as well as – in various grains of a loaded poly-crystal), which appear due to the Big Bang and are identical to each other. Based on the above we can suppose that our visible Universe is a "mono-universe" which is a component of "poly-universe" that is a conglomerate of the countless mono-universes in analogy with mono-crystals or grains in a poly-crystal.

A possible graphical illustration of the proposed ideas is given on Figure 1. Evidently that, within each mono-universe (a grain of a policrystal) there are its own energy carriers which can move as non-periodically as periodically in a corresponding

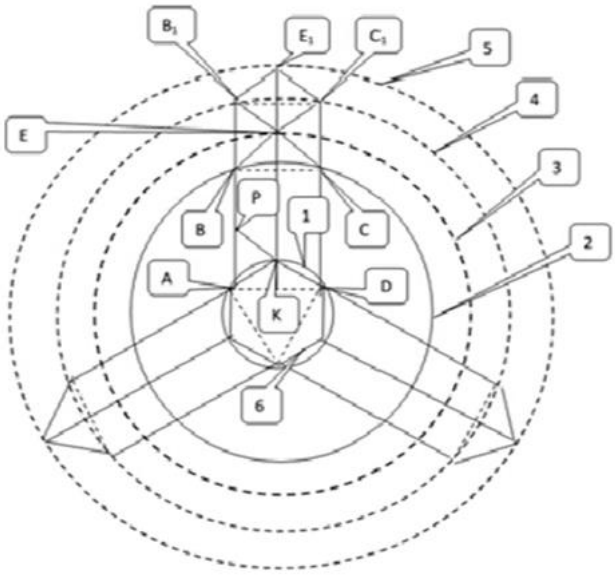

Figure 1: Schematic illustration of evolution of the whole Universe as a poly Universe comprising some mono-universes as visible ones. Circles show various steps of the poly -Universe expansion from the Big Bang epicenter. Rectangle ABCD corresponds to one of three shown pairs of mono-Universes with initial states of Big Bang products.. Polygon $AB_1E_1C_1CD$ shows some final state of the initial rectangle ABCD due to its consecutive elongation in one of three shown radial directions . (See text for details)

(each grain) space region. These conclusions are in a good accordance with data [17] known for plastic deformation of a policrystal.

Taking into account possible misunderstanding the above scheme (see Figure 1), lets consider in more detail the proposed mechanism of the numerous mono-universe participation in the poly–universe expansion.

At first, we assume that the Big Bang epicenter was located in the centre of all shown circles, which form surfaces limiting the distribution of the Big Bang products at various moments of time. Here on the scheme, such circles corresponding an arbitrary time intervals after the Bang are shown as (1), (2)…(5). The circles (1)

and (2) we shall consider as corresponding to initial surfaces, which limiting the products distributions at the times of, respectively, the beginning (circle 1) and finishing (circle 2) the Big Bang.

It is important to emphasize here that under the absence of material objects it is impossible to define a location for one of the object. Meantime, only under existence of several material objects it is possible to determine their relative positions or configurations. In other words, it is impossible to define relative locations of material objects due to the absence an origin of the coordinates which has to be one of the objects. However, under the presence of several material objects any of them may be used as the space and time coordinate origin together with their motion with definite direction.

So, only under existence of the Big Bang products and their motion it is possible to determine their time and space coordinates by repeatedly measuring the relative positions of the same product object. Therefore, the motion of the Big Bang products due to conservation of the Big Bang energy provides relative changes of the objects configurations that should be considered as changes of their space-time coordinates.

In order to proceed, we approximate the inner circle (1), corresponding to a finishing time - moment of the Big Bang, by the hexagon (6) for simplicity. Evidently that for an exact approximation of a circle, a polygon with an uncountable number of sides should be applied. Based on the shown scheme, lets consider a part of the volume occupied by the Big Bang products, e.g. a part of the spherical ring volume filled with the material objects been in some initial states, for example – rectangle ABCD and possible evolution of its form during the Universe expansion. It should be noted that, such an analysis may by conducted for any arbitrary chosen rectangle analogous to ABCD and situated at any part of the spherical ring volume due to the supposed isotropic the Big Bang products radial distribution.

For the considered as well as for any similar situation, the motion of the Big Bang energy carriers away from its epicenter in a radial direction has to develop under an action of the energy gradient to conserve the Big Bang original energy. Such a motion of the carriers provide in fact the shear “deformation” of an initial rectangle ABCD comprising the Big Bang products that leads to the ring expansion away from the epicenter. In the situation shown on Figure1, we consider the rectangle ABCD for illustration of the proposed mechanism of the visible Universe expansion. As it seen, such an initial rectangle (ABCD) transforms in a polygon ABECDK consisting of two parallelograms: ABEK and KECD. It should be noted that such a transformation is similar to formation of a martensite crystal by the twin mechanism [4]. It is necessary to note also the following: - the above transformation may develops in any point within the Big Bang products arrangement, (within the spherical circle) in any movement of their evolution (motion away from the Big Bang epicenter); - the energy carriers providing the transformation or the shear deformation, move exclusively in a radial direction in respect to the Big Bang epicenter.

So, we assume the same mechanism development within all possible rectangles which may be constructed on a pair of countless sides of the initial approximating polygon (6). Besides due to successive spreading the energy carrier motion along the radial directions, we shall get expansion of the outer circle (2) to the 3-rd, 4-th ones and so on. Thus, finally we shall get elongation of all polygons along the directions of the energy gradient or

corresponding force action, that provides the Universe expansion.

Evidently that the above interpretation of the analytic approach results and proposed mechanism requires additional thorough analysis in respect to the Universe evolution. However, the preliminary one provides: - an agreement of the above results with modern cosmological data, showing the flat shape of our visible Universe [18], some psychology models assuming existence of several rigorous scenarios for a human life development [19] as well as - possibility to ground the multiverse interpretation [20,21] of the quantum mechanics.

Thus, the above considered results of the early developed analytic approach application to the NSP analysis [10-12] combined with the analogy principle give an opportunity to provide physical grounding to such contemporary paradigms in the fields of morality, ecology, cosmology: necessity to protect, conserve and enlarge human and other living creatures lifes; possibility to travel in various directions in time; possibility of existence of numerous universes excepting our visible one. .

2.2. Relations of the Chaplygin gas models with the NSP analytic modeling results

It is well known that among the unresolved problems of modern physics, the ones concerned with the phenomena of the Dark Matter and Dark Energy existents are the most important and actual [18, 22]. These problems are in a close relations to the contemporary paradigm of modern cosmogy: creation our Universe by the Big Bang and its further inflation up to nowadays.

By now numerous models have been developed to explain the phenomena [5-8,16,22]. Among such models the most perspective ones are considered to be the Chaplygin gas (CG) models [7,8,22, 23]. There have been developed some types of the CG models which adequately describe various aspects of the Universe evolution. However, no the universal successful CG model has been developed yet. Taking into account the various successful predictions of the early developed analytic approach of an NSP, lets consider compatibility of the early developed analytic model with the CG models.

As it known [8] the base of any CG model is the equation of state (ES) in the form:

$$P = - A/\rho^{\alpha} \qquad (1)$$

where P – is a stress acting on a system of energy carriers, MPa,

ρ - volume or square density of the energy carriers, m/m^3

$0 < A < \infty$ and $0 < \alpha < 1$- are constants

Due to considering a thermodynamic system of energy carriers it is necessary to take into account the existence of minus sign in the equation (1) which appearance depends on succession of the thermodynamic interaction of a system and surrounding reservoir [24]. Namely: the minus sign corresponds to doing work under a system by a reservoir and vice versa. Taking this into account, further we shall consider any ES in absolute values. During

considering wider ranges of cosmological data, some modified CG models were also proposed [25], where the corrected ES was used.

To go further, lets consider the following relations which flow, respectively, from the dislocation theory [13] and the developed analytic model of a NSP[10-12]:

$$\gamma^{\cdot} = \rho \cdot b \cdot V, \quad (2) \qquad V = c \cdot \exp(-(P_0/P)^n)$$

where: $\gamma^{\cdot}$ - is the dimensionless velocity of a system shear deformation during its expansion from an epicenter of an energy gradient, in a radial direction as a result of the NSP development. Due to high importance of the quantity in further analysis, we shall consider its meaning in detail later using the scheme shown in Figure 1.

b – absolute minimal expansion of a system in its radial direction due to the system shear deformation as a result of one of the numerous system energy carriers going out the visible system limits (Burgers vector of a plastically deformed crystal), m;

c – maximal possible speed of a single energy carrier motion in a system (speed of sound in a deformed crystal);

P_0 – maximum possible stress can be applied to a system without its destroing;

$P = P(t)$– current value of the external stress applied to a system;

t - current time of the NSP development resulting to a system expansion;

$n = n(t)$ – parameter of the analytic approach associated with degrees of freedom for a single energy carrier in a system.

Elementary algebraic transformations of the above relations yield:

$$\rho = \gamma^{\cdot} / b \cdot V, \qquad (3)$$

$$c/V = \exp(P_0^n/P^n), \qquad \rho = (\gamma^{\cdot}/c \cdot b) \cdot \exp(P_0^n/P^n) \qquad (4)$$

As it seen from the above, the last (4) of the obtained relations: $\rho = \rho(P,n)$ in fact describes the dependence $\rho = \rho(t)$ because of $P = P(t)$, and $n = n(t)$. It should be noted here that the above last two relations provide substantial differences in the following calculated time dependencies: $c/V = c/V(t)$ and $\rho = \rho(t)$ for the 1-st and 2-nd regimes of a NSP development [10-12]. Moreover, using the time dependence $\exp(P_0^n/P^n)$ it may be seen that the dependence for the 1-st regime does not provide any coincidence of the calculated and the known Chaplygin gas relations: $\rho = \rho(P)$. So, one of the conclusions having been made right now is as follows: only 2-nd regime of a NSP development in a thermodynamic system under the increasing stress corresponds to the considered phenomena in the expanding thermodynamic system. That is why, we shall consider further the relevant expressions describing exclusively the 2-nd regime of a NSP development.

As it was noted above, a possible additional consideration is needed for of the Universe evolution by an application of the analytic model originally developed for the case of the tensile plastic deformation which is proceeded by the dislocation motion in a crystal under the action of shear stresses. One of the quantity which requires such consideration is γ' – the dimensionless speed of our visible Universe expansion. A possible mechanism of the Universe expansion as a result of the grand NSP development we shall discuss now using the scheme on Figure.1 for illustration.

We shall base on the given above considering the nominal initial state of the Universe, which corresponds to a time moment since the Big Bang appearance and includes the following main elements: epicenter of the Big Bang originally located in the centre of all spherical surfaces limiting the spreading of the Big Bang products with time; the limiting surfaces (1)…(5); hexagon (6) approximating the inner circle-type surface (1); an initial rectangle ABCD limiting an area within the space filled in the Big Bang products. Besides, we also suppose that the Big Bang products motion can develop in any radial direction, that provides shear deformation of an initial space area. As an example, we return to consider initial spatial rectangle area ABCD which transforms to a pair of parallelograms: ABEK and KECD due to the ABCD shear deformation. Thus, we consider shear deformation which provides elongation of the initial rectangle area in a radial direction relative the Big Bang epicentre because of above analyzed transformation: ABCD $\rightarrow$ ABEK + KECD. It is important to note here the following: the above transformation is similar to the formation of a martensite crystal [4] in a micro-crystal (grain); the motion of all existing energy carriers along the all possible radial directions during the Universe evolution provides its expansion.

3. Numerical evaluation of the data values used in calculations

Now, to provide further possibility to evaluate wide applicability of the early proposed analytic approach, we must verify the conclusions of the approach in respect to the known Universe evolution phenomena. To do so we, first of all, have to specify as precise as possible the corresponding available experimental data values. Here, however, it is necessary to emphasize probably the main feature of such data: absence of rigorous numerical values for the most of them due to impossibility to conduct direct experiments and measurements.

Nevertheless, due to the absence of other possibilities, let us begin the further analysis from considering NSP dimensionless velocity of size changes for a system which is under the action an external energy gradient. Here we are about the value γ^{*} for our visible Universe.

For the case of such NSP as the macroplastic deformation during tensile loading of a poly-crystal, such a variable is a prerequisite of the applied experimental procedure and has as a rule values: $10^{-3}…10^{-6}$ s^{-1}. For the case of the Universe evolution we shall be based on the following considerations.

As it was mentioned above, the density of the energy carriers, ρ, we have defined using the formula (2) or (3) which includes dimensionless speed of the Universe expansion, γ^{*}, and the absolute minimal shear b caused by one of the energy carrier going out our visible Universe. Because of practical absence of available data concerned with the both quantities, ρ, γ^{*}, we shall proceed from that our Universe reached its visible diameter:

D_{vu} = $8.8 \cdot 10^{26}$ m during own expansion in the course of its existence e.g. by the time which was directly measured as $T_{vu} \sim 14 \cdot 10^9$ years + ~ 379000 years or about $4.5 \cdot 10^{17}$s. Besides, in order to define dimensionless speed we relate the ordinary average speed to a distance on which we can observe and control any object from the Earth e.g. the radius of the visible Universe: $R_{vu} = D_{vu}/2 = 4.4 \cdot 10^{26}$ m. In addition, the distance R_{vu} is also close to the path which is gone by any energy material carrier in a direction of the relevant force or the energy gradient action in the whole or poly-Universe. So, we shall consider relation $(D_{vu}/(T_{vu} \cdot R_{vu}) \approx \sim 4.4 \cdot 10^{-18}$ s^{-1}, as the numerical evaluation of the dimensionless velocity of our visible Universe size changes. Further, we can evaluate the density of the energy carriers using the above given relation as: $\rho = \gamma^{*}/ b \cdot V$.

Here it is necessary to emphasize the important role of the numeric value of b in the above relations. Namely, if we shall consider b as a diameter of a barion (~ $1.5 \cdot 10^{-16}$ m) which is a representative of the order (baryonic) matter, then we have: $\rho \approx \sim 4.4 \cdot 10^{-18} / (1.5 \cdot 10^{-16} \cdot V) \approx \sim 3 \cdot 10^{-2}/V$. Evidently, this case corresponds the transferring the Big Bang energy preferably by barions which should be considered going out of our visible Universe after they reach the above distance which is considered to be the radius of our visible Universe. On the other hand, it is possible to consider b as a characteristic of the other types of the energy carriers. As an example we may use the value which is close to the minimal object size may be directly measured today [23]: ~ 10^{-19}m. So, we shall have for such a case: $\rho \approx \sim 4.4 \cdot 10^{-18}/(9 \cdot 10^{-18} \cdot V) \approx 0.5/V$. The one more case of transferring the Big Bang energy to the end of our visible Universe may be provided by the carriers having diameter close to 10^{-18} m. Then, we shall have for the density of such carriers: $\rho \approx \sim 4.4 \cdot 10^{-18}/(4 \cdot 10^{-17} \cdot V) \approx 0.11/V$. The time dependencies of the ρ in the above cases are shown in Figure 2. It is important to note the different types of the energy carriers for the above cases of the Big Bang energy transferring.

Before we proceed, lets verify the above evaluations by using the data related to the Universe expansion feature. As it was shown [25], the feature is that the expansion was not uniform in time. Namely, during ~ 4…6 billion years ago or, in average, ~ $1.3 \cdot 10^{17}$ seconds from now to the past, there started the acceleration of the Universe evolution which is developing now. Meantime more earlier, closer to the Big Bang epicenter, there was the Universe deceleration which was last detected at ~ 11 billion years or $3.5 \cdot 10^{17}$ seconds ago from now. Besides, according to [25] and the data [26], there was evaluated that probably extrapolated mentioned above age of the Universe is: about 14 billion years plus additional time period just after the Big Bang occurrence: 379 000 years until nowadays that as a whole is equal to about 14.2 billion years or ~ $4.5 \cdot 10^{17}$ seconds up to now. Taking into account the results of the analytic approach based calculations [10-12, 15] which demonstrate the same time dependence character for an energy carrier velocity , we have calculated the velocity values at the time about $4.5 \cdot 10^{17}$ seconds from the Big Bang occurence, which according to [25,26] corresponds to nowadays. As a result of the calculations we obtain the following speed values: from ~$1 \cdot 10^5$ to ~$9.4 \cdot 10^4$ km/s under the following values of the analytic approach constants: $A_2 = 10^{2...5}$; $t^* = 1.3 \cdot 10^{17}$ s. On the other hand, based on the Hubble`s law [27], we have practically the same University expansion velocity under the Hubble constant values: 75…77 km/(s Mpc), for the same our localization point in the Universe or the time of our existence. Further, we have to evaluate the quantity ρ. Based on the above definition, see the relations (2, 3), it is necessary to take into account various elementary particle types which are considered to be foundation of the Big Bang products and potentially able to transfer the Big Bang energy. As it was mentioned above, one of the main types of the

particles been the foundation of the ordinary matter are barions, their diameter is about $1.5 \cdot 10^{-16}$ m [28]. For this type of the Big Bang energy carriers at a time about $4.5 \cdot 10^{17}$ seconds corresponding nowadays, we have the number of baryon density: 0.03 m^{-2} . Besides, it is well known, that there are the tinier particles in the Universe, namely, - quarks and neutrinos [29,30]: $r_P < 10^{-16}$ m. Such particles may correspond to the Dark Energy and the Dark Matter. Assuming, respectively, $r_P = 4 \cdot 10^{-17}$ m and $r_P = 9 \cdot 10^{-18}$ m, we shall havethe corresponding density values: 0.1 m^{-2} and 0.5 m^{-2}. It is important to note the calculated percentages of contributions for the above particles into the whole amount of the energy transferred at our time by the grand NSP in the Universe. The percentages are, approximately, as follows: 78 %, 18 %, 5 % respectively, for the above particle types. As it seen, the calculation results are in a good agreement with the known relevant literature data concerned to, respectively, the Dark energy, Dark matter and baryonic or ordinary matter. [18]. So, taking into account the above verified results related to the time dependence character and specific speed values of the Universe expansion, as well as calculated contributions of various types of elementary particles as the energy carriers, into general balance of the Big Bang energy transferred, we may conclude the principle numerical applicability of the early developed analytic approach to analysis of the Universe evolution. Besides we may also suppose that the Dark energy may be associated with a part of the whole number of the Big Bang energy carriers which are elementary particles interacting exclusively with each other but not - with the other particles, due to they are in a very deep self-interacting energy well. Meantime, the Dark matter may be formed by the particles being in less deep self-interacting energy well that allows them to take part in a weak interaction with the ordinary matter

Going further we calculated time dependencies $\rho = \rho(t)$ and $P = P(t)$, which are shown on Figure 2.

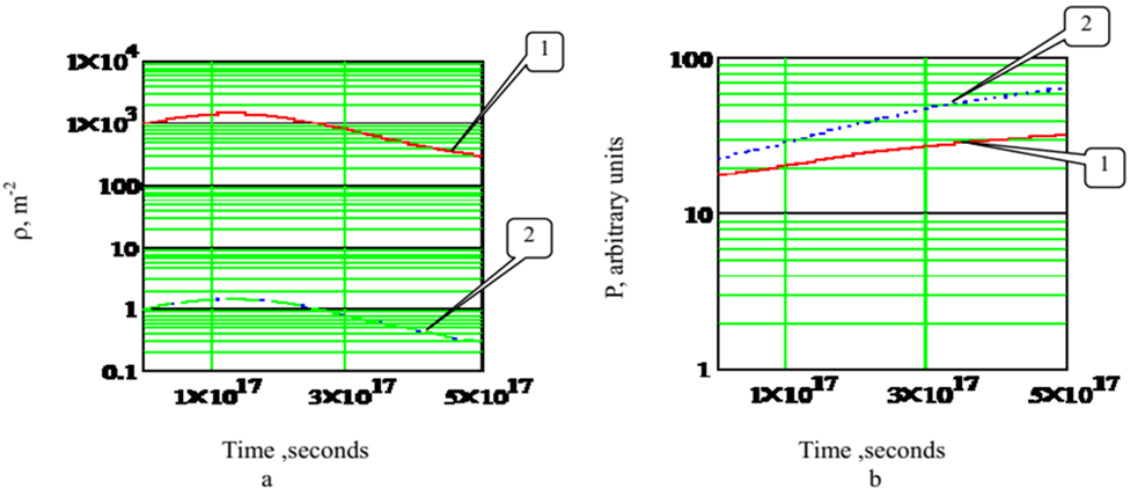

Figure 2: Time dependences of ρ and P calculated according to the early developed analytic approach [10-12] at the following constants values: $A_2 = 10^2$ (curves 1), $A_2 = 10^5$ (curves 2) , $t^* = 1.3 \cdot 10^{17}$ seconds. (a) – square density of number of the Big Bang energy carriers; (b) – stress (volume density of the Big Bang energy gradient) leading to the carriers motion providing the visible Universe expansion.

As it seen, all of the dependencies $\rho = \rho\ (t)$ and $P = P(t)$ calculated at various values of the model constants, shown on the Figure 2, respectively have the analogous character, which corresponds as a whole the reciprocal dependence $\rho = \rho\ (P)$ well known for the Chaplygin gas from the literature [7, 8]. However, the rigorous reciprocal dependence $\rho = \rho\ (P)$ may be evidently observed only in definite interval of t: $t > 1.3 \cdot 10^{17}$ seconds, including our time. As may be seen from the graphs, a practically direct dependence P from ρ or vise versa there is at times $t < 1.3 \cdot 10^{17}$ seconds, e.g. on early stages of the Universe evolution.

4. Approximating relations for the densities of the Big Bang energy carriers and the driving energy gradient for their motion

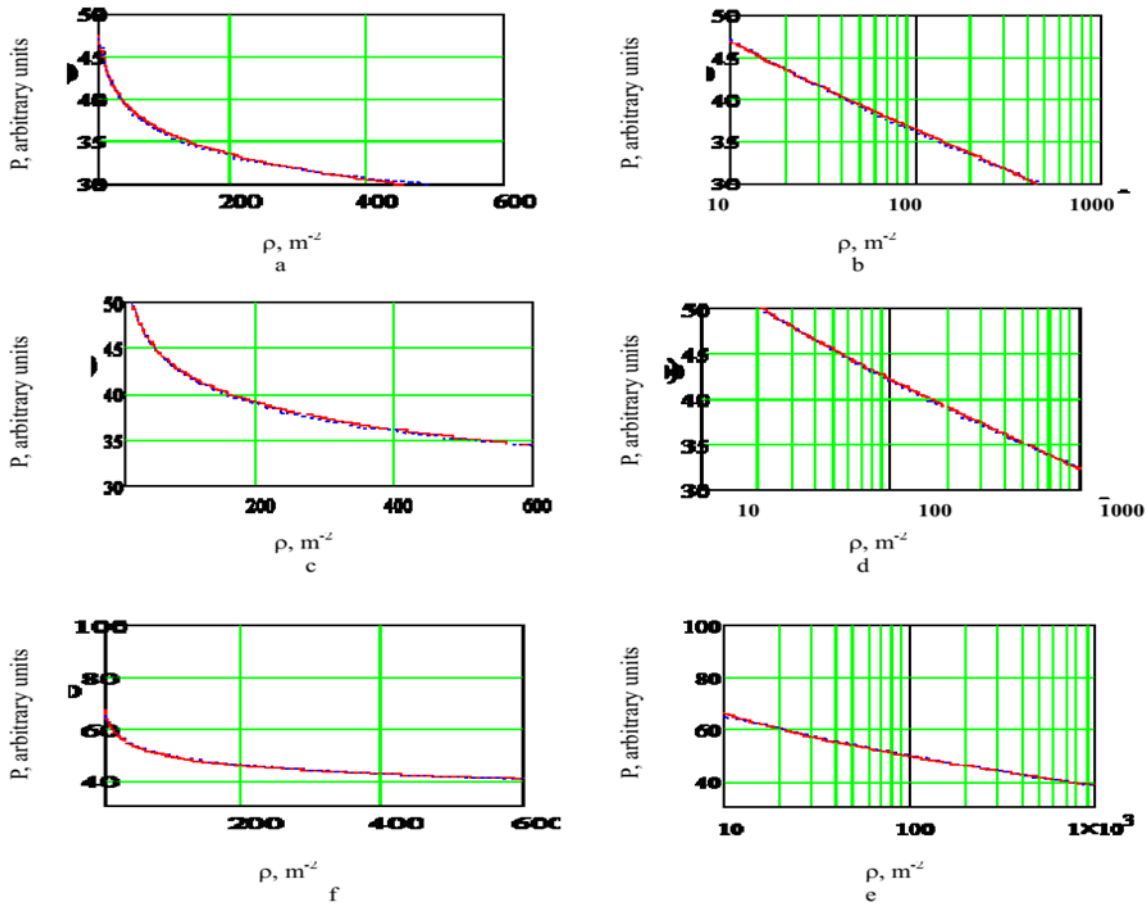

Figure 3: Calculated approximating dependencies P= P(p) for the various types of the Big Bang energy carriers having different radii r_p and associated with the known types of the Universe components: (a), (b)- $r_p = 1.5.10^{-16}$m_ baryonic (ordinary) matter ; (c), (d)-$r_p = 1.5.10^{-17}$ m_dark matter; (f), (e)- $r_p = 9.10^{-18}$ m_dark energy.(a), (c), (f) normal coordinates ; (b), (d), (e) semi-logarithmic coordinates.

As it was noted above, there have to be theoretically determined relations between the square density of the Big Bang energy carriers and driving force (energy volume gradient or stress) for their motion. Based on the above calculated time dependencies (see Figure 2) we have obtained such relations by an approximation of the time

dependencies using algebraic expressions. Some main results of the approximation are shown on Figure 3 together with the algebraic expressions, corresponding ordinary matter (5), dark matter (6) and dark energy (7):

$$P_{om} = 61.5 \cdot \rho^{-0.116} \quad (5); \qquad P_{Dm} = 70 \cdot \rho^{-0.111} \quad (6); \quad P_{DE} = 85 \cdot \rho^{-0.115} \quad (7);$$

As it seen, all the relations and the graphic dependencies on Figure 4 have the similar character, well known for Chaplygin gas models [6, 7]. Evidently, further investigations are needed, relate to modified CG models, the early Universe evolution until starting the acceleration and general ties with the theoretical cosmology results.

5. Conclusions

[1]. Based on the numerous common features of various NSPs, they have been considered as similar ones.

[2]. An early developed analytic model, well describing one of the NSP – macro-plastic deformation of crystalline solids, is applied to analyze the Universe evolution

[3]. Some basic coincidence of the analytic model results with the observed Universe evolution phenomena is shown that allows to deep understanding the relevant mechanisms and grounds some important contemporary paradigms in the fields of morality, religion, ecology etc.

[4]. Non-monotonic time dependence of the Universe expansion speed is shown to be predicted by the analytic approach application.

[5]. Existence of uncountable mono-universes (visible ones) is shown theoretically and a mechanism of their participation in the evolution of the whole poly-universe is proposed.

[6]. Theoretical evaluations of the contribution of the Big Bang energy carriers of various sizes in the energy transferring flux are made together with the relevant percentage calculations. The calculation results obtained are in accordance with the literature data known for the ordinary matter, Dark matter and Dark energy

[7]. An assumption is made regarding nature of the Dark matter and Dark energy, according to which they are made of successively tinier elementary particles being carriers of the Big Bang energy

[8]. Time dependencies of the square density of the Big Bang energy carriers and the driving energy gradient (stress) for their motion are calculated. The widely discussed their reciprocal mutual dependence are observed on the latter stage of the Universe evolution.

[9]. The reciprocal mutual dependencies for the density and the stress are approximated by the algebraic relations, parameters of which are in accordance with the literature data.

[10]. As limitations of the developed analysis the necessity to establish close relations with the modern theoretical and experimental cosmology results was noted.

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