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About Possibilities of Physical Unrealizability of Cosmological and Gravitational Singularities in General Relativity and Relativistic Gravithermodynamics

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Abstract

The possibility to avoid physical realizability of cosmological singularity (singularity of Big Bang of the Universe) directly in the orthodox general theory of relativity (GR) and in its improved version – the relativistic gravithermodynamics (RGTD) is substantiated. This can take place in the case of counting of cosmological time in frame of reference of coordinates and time (FR) not co-moving with matter, in which by the Weyl hypothesis galaxies of the expanding Universe are motionless. The absence of any limitations of the value of mass of astronomical body, which self-contracts in the comoving with expanding Universe FR (CFREU), when it has hollow topological form in the space of CFREU and mirror symmetry of its intrinsic space, is shown. Because of this symmetry, both external and internal boundary surfaces of body are observed as convex. At that, in the "turned inside out" internal part of the intrinsic space (in the Fuller-Wheeler lost antiworld) unlike external part, instead of the phenomenon of expansion phenomenon of contraction of "internal universe" is observed. And there is antimatter instead of matter in this internal part of the space. Inevitability of self-organization in physical vacuum of spiral-wave structural elements, which correspond to elementary quasiparticles, and universal electromagnetic nature of all non-fictive quasiparticles are substantiated. Ultrahigh luminosity of quasars and certain types of supernovas is caused by annihilation of matter and antimatter. It is proved that only in the case of the joint application in the Universe of a physically homogeneous exponential scale of unified gravithermodynamic time and a dynamic gravitational field, which ensure the invariance in space and time of the vacuum velocity of light and the Hubble constant, it is possible to ensure not only the general covariance of all physical laws, but also the gravitational-relativistic invariance of thermodynamic parameters and potentials of matter. Although the use in the Universe of a metrically homogeneous uniform scale of the proper time of matter and of a static gravitational field ensure the eternity of the existence of the Universe and the non-exceeding of the values of the false coordinate velocities of light of the GR by the radial velocities of distant galaxies, it does not ensure both the general covariance of all physical laws and the gravitational-relativistic invariance of thermodynamic parameters and potentials of matter.

Keywords: General Relativity, Gravithermodynamics, Universe, Cosmological Singularity, Big Bang, Black Holes, Dynamic Gravitational Field

1. Introduction

The existence of singularities in the General Relativity (GR) is considered by Einstein and later by the most authoritative specialists in this branch of physics (Ivanenko, Möller, Hawking) not only as the most apparent difficulty of this theory, but also as the sign of limitation of its application region [1-5]. Being based on this and on the evidence of mathematical inevitability of existence of singularities in GR, many attempts of radical upgrade of GR applying to big densities of matter are undertaken [6,7]. We have chosen another way to solve this problem in Relativistic Gravithermodynamics (RGTD) [8-10].

The process of expansion of the Universe as whole can take place only, if it takes place in every single point of its infinite space. The presence of this process may be caused only by evolutional variability of the properties of physical vacuum and,

therefore, by "adaptation" of matter elementary quasiparticles to continuously renewed terms of their interaction. Therefore, apparently, distances between quasi-motionless in the comoving with expanding Universe frame of reference of spatial coordinates and time (CFREU or Weyl FR) galaxies (according to Weyl hypothesis, in this FR they take part only in small peculiar motions) elongate in FR, comoving with evolutionally self-contracting matter, not because of the expansion of cosmic space into "nowhere", but because of the continuous shrinkage of length standard in CFREU [11-14]. The last is caused by gauge change (which is unobservable in principle in FR of people's world (FRPW or the matter FR) because of gauge invariance of people's world) of values of spatial parameters of elementary quasiparticles, evolutionally self-contracting in fundamental space of RGTD (Newton-Weyl absolute space) [11,15]. This is the cause of continuous decreasing of dimensions of all Universe objects in CFREU. The fact that process, which takes place in megaworld, is caused by the processes, which take place in microworld, is in good agreement with existence of many correspondences in correlations between atomic, gravitational and cosmological characteristics – Eddington-Dirac "large numbers" and doesn't contradict with modern physical notions [2,16,17]. That's why we can consider the expansion of the Universe, in analogy to daily solar motion on the celestial sphere, only as phenomenon that is observed in some selected FR. Already ancient Greeks (Aristarchus of Samos (ca.310 – ca.230 BC) and Seleucus of Seleucia (ca.190 - unknown BC)) presumed, that in fact Earth revolves on its axis and around the Sun. But it took near two thousand years to make this the apparent truth for all. We can only hope, that phenomenon of Universe expansion won't have such fate.

Thermodynamic states of matter, examined in General Relativity (GR), are self-inducted by matter spatially inhomogeneous states of this matter. This fact is caused by the presence of gravitational field in matter: Gravitational field is the cause of spatial inhomogeneity of rates of intra-atomic physical processes in matter and, therefore, it inducts not only the curvature, but also physical inhomogeneity of intrinsic space of matter [10,11,18].

In rigid FR this physical inhomogeneity of the space is in the mutual inequality of values of such hidden thermodynamic property of the matter as false (mistaken) coordinate-like velocity of light v_{cv} in different points of this space, which is equivalent (but not identical) to the limit velocity of matter $v_l = c\sqrt{b}$ in a hypothetical static gravitational field, and therefore to the relative value of the frequencies of electromagnetic interaction $f \equiv \sqrt{b} = v_l / c$ in matter at rest in a gravitational field [14]. At the same time, the same relative values of frequencies may correspond to different absolute values of the frequencies of electromagnetic interaction in different substances. It is the relative values of these frequencies, as well as the limit velocity of matter v_l (which can conditionally be at rest at any point in the gravitational field) that take on a zero value on the event pseudo-horizon of the Universe. The false coordinate velocity of light in the GR, in principle, cannot be less than the Hubble velocity of matter, which is equal to the constant of velocity of light c on the event pseudo-horizon of the Universe, and even more so cannot be equal to zero on the event pseudo-horizon of the Universe. That is why the parameter $v_{cv} = c\sqrt{b}$ was carelessly called the false coordinate velocity of light in the GR.

In addition, the intensity of the gravitational field depends fundamentally not only on the propagation speed of the electromagnetic interaction, but also on the distance of interaction of elementary quasi-particles, which during the motion of matter is significantly reduced due to the isotropic kinematic self-contraction of matter in the Euclidean background space of the CFREU [19]. In the FR of the people´s world, as well as in the intrinsic FR of a moving matter, the reduction in the size of this matter is not observed in principle, but is manifested only in the presence of the kinematic curvature of the part of the space occupied by this matter.

After all, the false coordinate velocity of light is a characteristic of the space in which the movement occurs, and not at all a characteristic of the moving matter. Therefore, further here, instead of the coordinate velocity of light of the GR, the limit velocity of matter will be mainly considered. When a matter moves with a velocity v by inertia in a dynamic gravitational field, a change in proper value of the limit velocity $v_{lc} = \sqrt{b_c}c = \sqrt{bc^2 + v^2} = \sqrt{b_0}c = \mathbf{const}(t)$ of matter in principle does not occur due to complete mutual compensation by gravitational deceleration and kinematic increase in the fundamentally unchanged flow of the intrinsic gravithermodynamic time of matter which moves in this way.

2. Maximum Possible Velocity of Definite Matter Individual (Separate) Motion

The limitation of the velocity of physical bodies is indeed exists in rarefied gas-dust matter. However, this limitation is not related to the velocity of light in the matter or in hypothetic absolute vacuum. In airspace, as well as in dense matter, the charged micro-objects (protons) can propagate faster than the velocity of light. That is confirmed by the origination of the radiation, found by Cherenkov, in this case. In addition, the value of the false coordinate pseudo-vacuum velocity of light v_{cv}, used in the GR as a gravitational potential, can be close to zero in very dense and hot stellar nuclei. And despite this, the nucleus can move at a velocity v, which significantly exceeds its inherent value $v_{cvn} << v$. Therefore, this false coordinate velocity of light can be considered as the limit velocity only of the relative motion of matter in the nucleus in the FR of the star, and not of its motion in the FR of a distant observer.

On the other hand, hypothetical frequency of intranuclear interaction (alternative to the false pseudo-vacuum velocity of light of GR) decreases while approaching the gravitational attraction center unlike the real frequency of electromagnetic interaction in matter, which increases. This is in a good correspondence with the fact that thermodynamic and gravity-evolutionary processes have opposite directions and is related to the fact that frequency of electromagnetic interaction in matter is greater when the temperature of the matter is greater. Due to the same reason the

physical processes flow faster not on the surface but in hotter bowels of the astronomical objects despite the gravitational slowing down is predicted by GR for those processes.

The reason for limitation of velocity of physical bodies is indeed the nature of matter movement in the space. Physical vacuum is not carried away by physical body. Matter is only the non-mechanic excitement of physical vacuum (space-time modulations of its physical characteristics). Therefore, the perception of high-frequency discrete movement of the body in the space as the continuous motion is similar to cinematographic perception of discrete change of image frame. The limitation of body velocity can be related to the fact that it is impossible to reach infinitely high frequency of discrete change of Gibbs collective thermodynamic microstate (quantum «hologram») of the whole its GTD-bonded matter and to the fact that it is impossible to reach the zero value of the length of spatial step shift (quantum micromovement) of the body. This frequency and this micromovement are de facto the de Broglie frequency $\boldsymbol{\nu}_B$ and wave length λ_B of the moving body. That is why instead of denying the possibility of moving body to overcome the velocity of light we should state the principal impossibility to reach the extremely big velocity $v_l = \sqrt{vv_B} = v_{B\min}$ of individual (separate) motion of its homogeneous matter. And this corresponds to the tending of $\boldsymbol{\nu}_B$ to infinity, and tending of $\lambda_{B\min} = v_l / \boldsymbol{\nu}_B = h/mv_l\hat{\Gamma} = 0$ ($v = v_l$, $\boldsymbol{\nu}_B = \infty$, $\hat{\Gamma} = \infty$) to zero, when phase velocity of de Broglie wave propagation v_B reaches its minimal value, equal to maximal possible velocity $v_{\max}$ of individual motion of the homogeneous matter of the body ($v_{B\min} = v_{\max} \equiv v_l$).

Thus, the greater the gravitational mass $m_{gr0} = m_{00}c/v_l$ of an astronomical body, the greater the frequency with which de Broglie waves run on him, and therefore, the greater the frequency with which step-by-step movement of this body can be carried out. And this means that the inertial mass $m_{in0} = m_{00}v_l/c = m_{gr}v_l^2c^{-2}$ of an astronomical body, on the contrary, becomes as many times smaller. And therefore, the inertial mass of matter can be identical to its gravitational mass only according to the own clock of matter, when $v_l = c$. According to this, the GR currently actually uses an inertial mass that is equivalent only to the inert free energy $E_0 = m_{in}c^2 = m_{00}cv_l$ of matter, instead of a gravitational mass that is equivalent to the ordinary rest energy $W_0 = m_{gr}c^2 = m_{00}c^3/v_l$, identical to the multiplicative component of the thermodynamic Gibbs free energy of matter.

In addition, gravitational fields set only the gradients of the intrinsic values of the limit velocity matter individual (separate) motion, and not the intrinsic values of the limit velocity of matter individual motion themselves, which are determined purely by the thermodynamic parameters of matter. And this also applies to distant galaxies due to the logarithmic potential $\varphi_H = c^2\ln(v_{lcH}/c)$ of the dynamic gravitational field. And, therefore, the thermodynamic parameters and potentials, which are determined purely by the intrinsic values of the limit velocity $v_{lcH} = v_l\hat{\Gamma}_H = \sqrt{v_l^2 + v_H^2} = v_{l0} = \mathbf{const}(t)$ of definite matter individual motion, are not only relativistically, but also gravitationally invariant. Here $\hat{\Gamma}_H = (1 + v_H^2v_l^{-2})^{1/2}$, $v_H = H_Er$ is Hubble velocity of the radial motion of the galaxy.

Similarly, we have $v_{lc} = \sqrt{v_l^2 + c^2T_{00}^2(T_0^{-2} - T^{-2})} = v_{l0} = \mathbf{const}(r)$ for both the initial continuous medium of the hot Universe and the interior of astronomical bodies, where: $T_{00} = T_0v_{l0}/c = Tv_l/c = \mathbf{const}(r)$ is a constant that is inherent to a specific substance and is independent on external gravitational fields [23]. Since the constant T_{00ind} can be different for different substances, then at the same point in space at the same temperature T these substances will have different values of the limit v_{lHind} velocity of the individual (separate) motion of a certain substance of the galaxy.

Thus, the gravitational decrease in the flow of the proper time of matter is completely compensated not only by its directed motion by inertia, but by the chaotic thermal motion of its micro-objects. And this is what ensures the inherentness of a single gravithermodynamic (astronomical) time for all gravithermodynamically bound (GTD- bound) matter of astronomical objects. After all, the change in the collective thermodynamic Gibbs microstates of all GTD-bound matter is carried out with the same de Broglie frequency, and therefore, regardless of the unequal rate of flow of its proper gravity-quantum time at different radial distances from the center of the astronomical object.

Dense substances, in which the limit velocities of individual (separate) motion are less than the actual velocity, cannot move separately. They must be pushed by substances, in which the limit velocities of individual motion are greater than the actual velocity of their collective motion. Therefore, very dense substances must be contained mainly in the bowels of planets, stars and galaxies, so that they can move at extremely high velocities. And therefore, it is not at all accidental that very dense neutron stars are located only in the centers of galaxies. Because of this, the frequency of de Broglie waves that fall on them corresponds not only to their mass, but to the mass of the entire galaxy.

This is what allows the use of a single limit velocity of motion (in the RGTD for the group motion of many substances), which is inherent, for example, to the most common substance – the hydrogen that is the surface layer of stars (similar to the use of a single false coordinate pseudo-vacuum velocity of light, which is supposedly inherent to all substances, in the GR). If such a limit velocity of group motion is known, for example, for a star moving with a known maximum orbital velocity, then the equations of the gravitational field of the galaxy allow us to determine the limit velocities of group motion of a similar substance for stars moving with other orbital velocities.

Thus, not only local spatial features (the presence of own gravitational fields for the stars), but also the non-identity individual constants T_{00ind} for different substances is not taken into account in the universal equations of the galaxy gravitational field. And this takes place both in the GR and the RGTD. After all, according to the solutions of the equations of the gravitational field of the galaxy, the same values of the parameter $b_{lc} = (v_l \hat{\Gamma} / c)^2$ correspond to both the matter of the stars and to almost empty space that surrounds them. That is, hydrogen and other substances are supposedly dispersed in the space surrounding stars and planets, rather than concentrated inside them. But these solutions of the equations of the galaxy gravitational field reflect the general tendencies realistically.

In distant galaxies which are not conditionally cooled, as well as in any bodies moving in a gravitational field by inertia, the value $v_{lHind} = cT_{00ind} / T = \mathbf{const}(t)$, corresponding to a particular substance will be the same as in the same substance on Earth only at the same absolute temperature. In the hot matter of distant galaxies, as in the matter in the bowels of the Earth, it is much smaller and gradually increases with a decrease in its temperature. And the much smaller value v_{lH} in the matter of distant galaxies is well consistent with the gradual cooling of the very hot matter of the Universe in the distant past.

Unlike gases, the internal energy of solid matter includes not only thermal energy, but also consists of many products of intensive and extensive thermodynamic parameters. Therefore, it would seem logical to identify gravitational energy, which is equivalent to the gravitational mass of matter, with it. But in fact, it is not this energy at all, and not even enthalpy, which is identified with the energy of an expanded system, but only the multiplicative component of Gibbs free energy, which does not include the released thermal energy $W_T = ST$, can be considered identical to gravitational energy, and therefore equivalent to the gravitational mass of matter [24]. After all, many experiments have proven that heated bodies have a weight that is not at all greater, but, on the contrary, less than a weight of cold bodies [25,26].

3. Substantiation of Admissibility of Evolutionary Process of Gauge Self-Contraction of Matter in GR and in RGTD

Because of motion relativity, at the first sight it seems that there is no difference if space expanses relatively to matter or matter self-contracts in space. But in fact the difference between these processes is present and this difference is very essential. World points, in which points of conditionally empty (unfilled with matter) intrinsic (characteristic) space of self-contracting body move in fundamental (Newton-Weyl absolute) space with supraluminal velocity, are found beyond the limits of space-time continuum (STC) of this body. At that, conditionally empty intrinsic space becomes self-limited by event (observer) horizon. Furthermore, inequality of relativistic shrinkages of dimensions and relativistic time dilations in different points of intrinsic space, which is caused by inequality of velocities of these points, leads to onset of curvature and physical inhomogeneity of intrinsic space of self-contracting body correspondingly.

The spaces, in which contraction takes place, don't have all this and may be unlimited and infinitely large. Therefore, if cosmic space expands relatively to matter, then event (observer) horizon will limit CFREU space. And if, as we consider, matter contracts in cosmic space, then event (observer) horizon will limit space of FRPW, comoving with matter. In conventionally empty space of self-contracting body, namely in its distant regions, points of which move in CFREU at velocities higher then velocity of light, there are no physical bodies, dragged by this space. On the contrary, all astronomical objects, conventionally motionless in CFREU, are dragged by expanding cosmic space. And at arbitrarily large distances from observer they can move, according to Hubble relation, at any high speeds. However, velocity of physical object can't exceed velocity of light in the point, where it's located. Therefore, at arbitrarily large distances from observer improper values of velocity of light must be arbitrarily large. This, however, doesn't follow from GR gravitational field equations. Otherwise, observer intrinsic space must be finite. And this is possible in case of Friedmann singular model of expanding Universe with its finite past, as well as in case of presence of observer horizon in matter intrinsic space. In case of eternal existence of Universe in the past, (this doesn't allow existence of cosmological singularity) there are no other known physical mechanisms, which form observer horizon of intrinsic space of any astronomical body, except relativistic or evolutionary shrinkage of dimensions. Therefore, phenomenon of Universe expansion can be caused only by gauge process of evolutional self-contraction of matter in cosmic space.

Such gauge (for intrinsic observer) matter self-contraction, which becomes apparent in relativistic shrinkage of moving body dimensions, has been recognized as physically real for the first time in special theory of relativity. In GR it is caused by the influence of gravitational field on matter and may be rather substantial in the process of relativistic gravitational collapse. But if such gauge self-deformation of matter is possible in fundamental space in case of transposition of body in space along the force lines of gravitational field, then why it can't be possible in case of "transposition" of body only in time? After all, because of unification of space and time in single STC (Minkowski four-dimensional space-time) coordinate time is equal to spatial coordinates in GR. In this case, gravitational field may be considered as demonstration of presence of time delay of the process of gauge matter self-contraction in the points more distanced from the center of astronomical body and as demonstration of presence of matter influence on the properties of physical vacuum via negative feedback. This feedback is realizing via changes of eigenvalue of molecules volume as well as of eigenvalues of densities of energy and enthalpy of matter. At the early stages of Universe evolution, when its whole space was filled in with matter, eigenvalue of molecules volume gradually increased and eigenvalues of densities of energy and enthalpy of matter gradually decreased. The same takes place in case of advance from the center of

astronomical object to its boundary surface, in other words – in case of advance in space, but not in time.

4. Imaginary Big Bang

In FR of people's world the Sun that "rotates" around the Earth has large kinetic energy of rotation. However, we ignore the fact that the Sun has this energy because we know well that the Earth rotates around its axis. Already Hermann Weyl proved that there exists such FR where only peculiar motion of distant galaxies takes place (where their radial motion is absent) [12,13]. Why then we grant "dark energy" to the whole Universe and not to the separate island galaxies within it. After all the Earth, together with its whole galaxy and all standards of length, is the collective spiral-wave formation that is gauge-self-contracting in the outer space [27]. And all of them together evolutionary decrease in infinite fundamental space of the Universe. The same applies to all other island galaxies.

Only two known solutions of equations of GR gravitational field can be juxtaposed to expanding Universe. Those are: Schwarzschild solution when the value of cosmological constant is $\Lambda=3H_E^2c^{-2}$, which corresponds to the local representation of the process of Universe expansion, and Friedman solution when $\Lambda=0$ ($\Lambda\neq0$ in ΛCDM model), which corresponds to the global representation of the process of Universe expansion [28-31].

According to Schwarzschild solution and Einstein hypothesis distant galaxies are falling free on the "event horizon" constantly moving along the geodesic lines of space-time continuum (STC) of their observer. They fundamentally cannot reach that pseudo-horizon of the past because it belongs (at any moment of observer's time) to infinitely far cosmological past (in coordinate cosmological time) as well as to infinitely distant objects of the Universe in its background Euclidean space of the CFREU [19]. And this is, of course, related to the conformality of these two infinities that are mutually compensated in the gravithermodynamic FR (GT-FR) of Schwarzschild solution. Exactly in this the background Euclidean space of the Universe, where physical vacuum rests, according to Weyl hypothesis galaxies perform only small peculiar moves [10-13,29,32]. And standards of length are evolutionally decreasing together with all objects of matter in this space.

So, any proto-micro-object of the Universe that has negligibly small mass ($r_g\approx0$), according to Schwarzschild solution in background Euclidean space $r=r_cR/(r_c+R)=cR/(c+H_ER)$ in infinitely far cosmological past had its own space that was limited by the sphere of maximal radius $r_{\max}=r_c\approx4812{,}4\ [Mpc]$ and that covered all infinite space of the Universe ($R_{max}=\infty$). Of course, in infinitely far past it could be only some "bouillon" of proto-micro-objects (spiralwave self-formation in the Universe). However, according to Schwarzschild solution we can not say about any creation of matter and space from some point object. So, the Universe protomatter (spiralwave self-formation in the Universe) existed eternally and took certain volume in intrinsic space covering by itself the whole infinite space of the Universe.

Friedman solution due to negligibly small values of average density of mass in the Universe (comparing to $3H_E^2/4\pi G$) and pressure in the outer space (comparing to $3H_E^2c^2/4\pi G$) is the special case of the Schwarzschild solution in the background Euclidean space of the Universe: namely in the FR of physical vacuum of identical CFREU when the value of gravitational radius of astronomical object, from which the observation of Universe expansion is performed, is negligibly small [11,29]. In contrast to Schwarzschild solution that includes the events pseudo-horizon in the equations of Friedman solutions (as well as in the equations of Schwarzschild solution in background Euclidean space) the event pseudo-horizon (on which the limit velocity of matter is equal to zero) is absent. This denotes the absence of the Hubble radial motion of galaxies and, thus, the absence of relativistic effects in the space of Friedman solution. Galaxies in this space perform only small peculiar moves while distances between them are increasing in this space due to mutually proportional decreasing of the dimensions of both length standards and all material objects in this space. This, of course, requires the constant renormalization of non-normalized spatial parameters to align them with the new values of the size of length standard.

Thus, there fundamentally cannot be any radial motion of objects in Friedman solution because of the absence of singular surface of event horizon in this solution. Therefore, Doppler Effect and other relativistic effects related to motion are not applicable for this solution.

Gravitational dilation of time, counted by quantum clock, takes place in GT-FR. Therefore, it makes sense to call this dilated time as gravity-quantum time, and to call all correspondent to that time values of physical characteristics as gravity-quantum values. The gravity-quantum time of any certain observer can be proportionally synchronized with the unified astronomical coordinate time (gravithermodynamic time) t_E owing to the possibility of proportional synchronization of all gravity-quantum clocks in GT-FR of Earth [10,33]. Thus, that gravity-quantum time will also be proportionally synchronized with the cosmological time τ, counted in the point of observer's disposition according to metrically homogeneous scale of cosmological time (CTMHS).

Comparison of the solutions of equations of GR gravitational field with cosmological Λ-part in GT-FR and in CFREU shows that precisely Λ-part is responsible for Hubble's expansion of the Universe [11,29]. The value of Hubble constant is also determined by this Λ-part: $H_E=c\sqrt{\Lambda/3}$. Λ-part also limits the maximal value of Schwarzschild radius $r_c\approx c/H_E=(3/\Lambda)^{1/2}$ in the space of GT-FR. However, it does not form the horizon of past events in GT-FR and CFREU [11,12]. World points of the pseudo-horizon, formed by Λ-part in GT-FR, correspond to infinity in space and time in CFREU. Mentioned above fact guarantees the possibility of existence of infinitely far cosmological past in CFREU when use CTMHS [33-35].

According to the Friedman's solution of equations of GR gravitational field for the flat space, the Universe expands

strictly exponentially. Therefore, its size should asymptotically tend to zero while deepening into infinitely far past.

And the theory of Big Bang of the Universe (that is based on its origination from a point) is false. After all the spherical surface that corresponds to infinitely far past of cosmological time has not zero, but, quite the contrary, maximum possible value of photometric radius in FR of people's world $r_c \approx c/H_E = (3/\Lambda)^{1/2}$.

The matter on the event pseudo-horizon of the Universe moves away from the observer with the Hubble velocity, which is equal to the constant of velocity of light, despite its immobility due to the constant radius of the event (visibility) pseudo-horizon and despite the zero value of the limit velocity of matter on this pseudo-horizon in the observer's FR. And this is perceived as a paradoxical phenomenon precisely because of the ignoring of both the correspondence of this pseudo-horizon of events only to the infinitely distant cosmological past, and because this pseudo-horizon covers the entire infinite fundamental space of the SFREU. The reason for this ignoring is the absurd idea of the emergence of the Universe from a point in the process of its "Big Bang".

However, the time that corresponds to any event of the past is finite in principle. That's why instead of infinite coordinate cosmological time finite path-like cosmological time is set in the Universe based on the imaginary primacy of any specific event. Of course, that time is based on assumed finiteness of the far past in the Universe. Big Bang of the Universe has been proclaimed as such fictive primary event.

Therefore, infinite cosmological coordinate time and finite cosmological intrinsic time should be distinguished [33]. The former is based on the infinitely long evolution of the Universe both in the future and in the past. The latter defines only the nominal age of the Universe approximately from the moment of spontaneous transformation of its protomatter into continuous hydrogen medium. Not very long in time but turbulent course of events until the creation of continuous hydrogen environment of the Universe indicates the usage of exponential scale of path-like (age) cosmological time instead of metrically homogeneous scale in cosmology.

Of course, the Friedman solution of equations of gravitational field of GR with zero value of gravitational constant is applied to the globally non-bonded matter of the Universe. The Universe has island structure [34-36]. Within the limits of each "island" (galaxy or the group of gravitationally bonded galaxies – small island "universe") cosmological constant is not equal to zero and its value $\Lambda = 3H_E^2 c^{-2}$ is strictly determined by the value of Hubble constant. The absence of the "center of masses" of unified gigantic stellar formation in the Universe makes the applicability of equations of gravitational field of GR to the description of the properties of the entire set of "islands" of the Universe (the entire island Universe) questionable. All these islands in the Universe perform only small peculiar movements in fundamental space of CFREU, while their radial movements in GT-FR of observer are caused by evolutionary self-contraction of the sizes (in CFREU) of spiral-wave self-formations that correspond to all micro-objects and macro-objects of matter. The Hubble constant, as well as intrinsic value of velocity of light, is fundamentally invariable magnitude since it ensures the continuity of the spatial continuum in rigid FRs and, thus, also in FR of people´s world (FRPW) [37]. And that is why it can gradually change only in non-rigid FRs [38]. After all, the invariance (in time) of the Hubble constant is the main sign of the rigidity of intrinsic FR of the observer. That is why the introduction of non-zero value of cosmological constant into Friedman solution does not have physical sense (as, obviously, there is no sense in the application of this solution for gravitationally non-bonded island objects of the Universe).

The one more thing is that we should not exclude is the possibility that GR can be inapplicable to the description of the universe evolution in far cosmological past – before the breaking (disruption) of its uniform gas continuum. Gravitational fields originate in Universe only after that discontinuity.

5. Internal Schwartzschild Solution for the Ideal Liquid in the Comoving FR

Let's examine Schwarzschild internal solution for ideal liquid, which is gauge-self-contracting in CFREU and, therefore, has rigid comoving (intrinsic) FR. In this intrinsic FR of liquid, which is inhomogeneously contracted by the gravity, linear element has static and spherically symmetric form:

$$ds^2 = a(r)dr^2 + r^2(d\theta^2 + \sin^2\theta \cdot d\varphi^2) - b(r)c^2dt^2,$$

where r is luminosity radius of spherical surface, value of which is determined by its area S $(r^2 = S/4\pi)$ and in principle can vary non-monotonically along metrical radial interval $\hat{r}$ in nonempty space with curvature [14]. Functions $a(r)$ and $b(r)$, which characterize curvature and physical inhomogeneity of liquid intrinsic space correspondingly, are connected here with eigenvalue of mass density $\tilde{\mu}(r)$ and eigenvalue of pressure $\tilde{p}(r)$ by differential equations:

$$d\tilde{p}/dr + \left(\tilde{\mu}c^2 + \tilde{p}\right)b'/2b = 0 \qquad (1)$$

$$-\frac{R^2}{r^3}\frac{\partial^2 r}{\partial R^2} + \frac{R^2}{r^4}\left(\frac{\partial r}{\partial R}\right)^2 - \frac{R}{r^3}\frac{\partial r}{\partial R} - \Lambda = -\kappa\tilde{p} \qquad (2)$$

$$a'/a^2 r + r^{-2}(1 - 1/a) - \Lambda = \kappa\tilde{\mu}c^2 \text{ [14].} \qquad (3)$$

From these equations we may find:

$$\frac{1}{a} \equiv \left(\frac{\partial r}{\partial \hat{r}}\right)^2 = 1 - \left(1 - \frac{1}{a_i} - \frac{\Lambda r_i^2}{3}\right)\frac{r_i}{r} - \frac{\kappa c^2}{r}\int_{r_i}^{r} r^2\tilde{\mu}dr - \frac{\Lambda}{3}r^2 =$$

$$= 1 - r_g(r)/r - \Lambda r^2/3 = 1 - r_g(r)/r - \left(1 - r_{ge}/r_c\right)r^2/r_c^2, \qquad (4)$$

$$b \equiv \frac{v_l^2}{c^2} = \frac{1}{a}\exp\int_{r_e}^{r}\Phi(\mathrm{r})dr = \frac{r_e}{ra_e}\exp\int_{r_e}^{r}\varphi(r)dr, \qquad (5)$$

where: $\Phi(\mathrm{r}) = (ab)'/ab = \kappa\left(\tilde{\mu}c^2 + \tilde{p}\right)ar;$

$$\varphi(r) = (r^{-2} - \Lambda + \kappa\tilde{p})ar;$$

$$a_i \equiv a(r_i);\ a_e \equiv a(r_e) = \left[1 - r_{ge}/r_e - (1 - r_{ge}/r_c)r_e^2 r_c^{-2}\right]^{-1};$$

$$r_g(r)=\left(1-\frac{1}{a_i}-\frac{\Lambda}{3}r_i^2\right)r_i+\kappa c^2\int_{r_i}^{r}r^2\tilde{\mu}dr \qquad (6)$$

is gravitational radius of internal part of liquid, separated from its upper external part by spherical surface with radius r; r_i and r_e are values in FRPW of radius in optional supporting point i of liquid body and on its boundary spherical surface correspondingly; v_l is limit velocity of matter, value of which is determined in astronomical time t of the whole liquid body FR and is not the same in different points of this body (depends on radial coordinate of the point of liquid body); c is eigenvalue of velocity of light, which is determined in proper quantum time of the point of light propagation, and, because of this, is the same in all points of matter intrinsic spaces (constant of light velocity); κ is Einstein constant; $\Lambda=3(1-r_{ge}/r_c)r_c^{-2}$ is cosmological constant, which determines (together with gravitational radius of the whole liquid $r_{ge}\equiv r_g(r_e)$) maximal value of luminosity radius in FR of liquid (radius r_c of event (observer) horizon of conventionally empty space above liquid) and, thus, shows the presence of adiabatic equilibrium process of gauge-self-contraction of molecules of liquid in cosmic space.

6. The Physical Essence of Observer Horizon and Schwarzschild Sphere. Cosmological Age of the Universe

It was shown by Lemaitre and independently by Robertson, that there is an appropriate transformation of coordinates, using which we can proceed from rigid FR, comoving with matter, to not co-moving FR, in which dimensions of both macro- and micro-objects of body matter mutually proportionally vary with time [14,41,42]. When values of gravitational radius of this astronomical body, located far from other astronomical objects, are negligible ($r_{ge}\approx 0$, that only formally corresponds to de Sitter Universe), we'll have: $r_c\approx\sqrt{3/\Lambda}=c/H_E$. At that, linear element of body in CFREU will have the following form:

$$ds^2=\left(1-r^2r_c^{-2}\right)^{-1}dr^2+r^2\left(d\theta^2+\sin^2\theta\,d\varphi^2\right)-\left(1-r^2r_c^{-2}\right)c^2dt^2=$$
$$=\frac{\left[dR^2+R^2\left(d\theta^2+\sin^2\theta\cdot d\varphi^2\right)\right]}{\exp\left[-2c(\tau-\tau_k)/r_c\right]}-c^2d\tau^2=\frac{dL^2-c^2d\tilde{\tau}^2}{\left[1-H_E\left(\tilde{\tau}-\tilde{\tau}_k\right)\right]^2}, \qquad (7)$$

where: $dL=\sqrt{dR^2+R^2\left(d\theta^2+\sin^2\theta\cdot d\varphi^2\right)}$;

$$r\equiv R_k=R\,\exp\left[H_E(\tau-\tau_k)\right]=R\left[1-H_E\left(\tilde{\tau}-\tilde{\tau}_k\right)\right]^{-1}<r_c, \qquad (8)$$

R_k is radial coordinate of optional world point of STC of evolutionally self-contracting body in CFREU in the time moment τ_k $(\tilde{\tau}_k)$ of calibration of the dimension of length standard in CFREU by its dimension in intrinsic FR of this body; $\tau=t+(r_c/2c)\ln(1-r^2/r_c^2)$ is time, which is counted in CFREU by the metrically homogeneous scale, by which the rate of quasi-equilibrium physical processes in matter doesn't vary, despite gradual shrinkage of distances between its interacting elementary quasiparticles [14]. Therefore, this time will be considered by us further as cosmological time; $\tilde{\tau}=\tilde{\tau}_k+(1/H_E)\left[1-\exp\left\{H_E(\tau_k-\tau)\right\}\right]$ is time, which is counted in CFREU by physically homogeneous scale, which is metrically noncalibrated, but guarantees invariance of values of limit velocity of matter $\tilde{V}_l=\left(\partial L/\partial\tilde{\tau}\right)_s$ and energy of radiation quanta during the process of light propagation [18,43].

Therefore, this scale (like length scale in CFREU) requires continuous renormalization. Due to renormalization of this time scale the moment of imaginary singularity (moment of matter self-contraction to zero dimensions) will be "expected" by it after the same finite time interval $\tilde{\tau}-\tilde{\tau}_k=H_E^{-1}$ independently of duration of passed time. And, therefore, in fact this moment of time is unreachable in principle. This means the physical unrealizability of such singularity.

$H_E=-V_H/R$ is Hubble constant, which determines in CFREU by metrically homogeneous time scale proportionality between velocity of the points of self-contracting body V_H and radial distance R to this points in Euclidean space of CFREU. The value of H_E does not evolutionary vary and, consequently, does not depend on the averaged value of density of matter in expanding Universe. Therefore, precise determination of the averaged value of this density, as well as the problem (connected with it) of existence of hidden mass or so called dark non-baryonic matter in the Universe, are nonactual. The value of the ratio $-\tilde{V}_H/R\neq\mathbf{const}(\tilde{\tau})$, which is determined in CFREU by physically homogeneous time scale, on the contrary, evolutionally varies and becomes invariant only when it's being continuously renormalized: $(-\tilde{V}_H/R)[1-H_E(\tilde{\tau}-\tilde{\tau}_k)]\equiv H_E$. Analogously, only continuously renormalized (in compliance with evolutional decreasing of material length standard) value of the velocity of light is invariant by the metrically homogeneous time scale in CFREU.

According to this, velocities of radial motion not only of macroparticles of self-contracting body matter, but also of all points of conventionally empty intrinsic space of gauge-self-contracting body are determined in CFREU by metrically homogeneous time scale via Hubble relation:

$$V=dR/d\tau=-H_ER_k\exp\left[-H_E(\tau-\tau_k)\right]=-H_ER. \qquad (9)$$

And they absolutely don't depend, as it was shown, on parameters of equations (1-3,18).

Taking into account relativistic time dilation, values of limit velocities of matter in FR of evolutionally self-contracting body (v_l) and in CFREU (V_l) will be connected by relationship:

$$v_l=c\sqrt{b}=V_l\sqrt{1-(V/V_l)^2}\,r/R, \qquad (10)$$

from where:

$$V_l=c\sqrt{b+\left(\frac{Vr}{cR}\right)^2}\,\frac{R}{r}=\sqrt{c^2b+H_E^2r^2}\,\frac{R}{r}=\sqrt{b_c}\,\frac{cR}{r}\neq\mathbf{const}(\tau). \qquad (11)$$

is the value of the limit velocity of motion of matter in the CFREU, which is actually a metrically renormalized value of the limiting velocity of motion of matter $v_{lc}=c\sqrt{b_c}=\sqrt{c^2b+H_E^2r^2}$ in the dynamic gravitational field of FRPW.

It should be kept in mind here that relativistic time dilation, like the ordinary Lorentz transformations (OLT) in general, is related only to the equilibrium process of the evolutionary self-contraction of matter in the CFREU and is related only to the rate of a hypothetical, absolutely motionless in the FRPW clock. This relativistic time dilation should be considered gravitational in the FRPW. Astronomical objects moving by inertia in the dynamic gravitational field of the Universe do not experience this time dilation, since the inertial motion of matter compensates for the gravitational change in the rate of time flow. Therefore, distant galaxies moving away from the observer at high velocity do not experience relativistic time dilation. After all, they are freely falling by inertia toward the events pseudo-horizon of the Universe. This is a significant difference between the non-uniform inertial motion of matter in a dynamic gravitational field and its uniform equilibrium motion during the process of evolutionary self-contraction of its size in the CFREU.

And thus, only a physically homogeneous unified gravithermodynamic (universal astronomical) time, which is based on the correspondence of the dynamic (and not static) gravitational field of the Universe to the true general covariance of physical laws, can be metrically homogeneous. The assumption that the metrically inhomogeneous (exponential) scale of proper time currently used in cosmology is physically homogeneous and, therefore, ensures the general covariance of physical laws is actually completely false.

Front of intrinsic time t of physical body corresponds to simultaneous (when intrinsic time is inhomogeneous – to coincident) events and propagates in intrinsic FR of body instantly in principle $(v_t = \infty)$ [43,44]. In CFREU this front will propagate, as it follows from Lorentz transformation for velocities, with finite velocity:

$$V_t = dR_t / d\tau_t = V_c^2 / V = -\left(c^2 b + H_E^2 r_t^2\right) R_t / H_E r_t^2 \qquad (12)$$

Since when $t(r) = \mathbf{const}$:

$$V_t = \left(\frac{\partial R}{\partial r}\right)\frac{dr_t}{d\tau_t} + \frac{\partial R_t}{\partial \tau_t} = \left[\frac{\sqrt{ab}}{r_t\sqrt{b + r_t^2 H_E^2 / c^2}}\left|\frac{dr_t}{d\tau_t}\right| - H_E\right]R_t,$$

where taking into account relativistic shrinkage of dimensions, when $\tau(R) = \mathbf{const}$:

$$\left|\frac{\partial R}{\partial r}\right| = \left|\frac{\partial \widehat{r}}{\partial r}\right|\sqrt{1 - \frac{V^2}{V_c^2}}\,\frac{R}{r} = \frac{\sqrt{a}}{\sqrt{1 + r^2 H_E^2 / c^2 b}}\,\frac{R}{r}, \qquad (13)$$

then, when $\partial r / \partial R > 0$, we'll have:

$$d\tau_t = -\frac{H_E r_t dr_t}{c[(c^2 b + H_E^2 r_t^2)b / a]^{1/2}_t} = -v_H v_l^{-2} d\widehat{r_t} = -dt_\tau, \qquad (14)$$

where: $v_H = -v_l V / V_l = H_E r / \sqrt{1 + r^2 H_E^2 / v_l^2}$ is the false Hubble velocity of an astronomical object, determined on a scale of metrically inhomogeneous time (exponential time, currently used in cosmology), with which it moves away from the observer (in its own frame of references), being conditionally motionless in the Euclidean fundamental space of the CFREU (Newton-Weyl absolute space) [43-45]. It is this false velocity that does not exceed the false coordinate velocity of light of the GR at each point in the proper space of the body on which the observer is located, and on the motionless event pseudo-horizon of conditionally empty space it is equal to zero, as is the false coordinate velocity of light on it. This velocity doesn't exceed limit velocity of matter v_l in every point of intrinsic space and is equal to zero on the motionless event horizon $(r = r_c)$ of conventionally empty space, the same as velocity of light:

$$v_{Hc} = \frac{v_l r}{r_c}\sqrt{\frac{1 - r_{ge}/r_c}{1 - r_{ge}/r}} = H_E r\sqrt{1 - \frac{r^3\left(r_c - r_{ge}\right)}{r_c^3\left(r - r_{ge}\right)}} = 0$$

But the use in the Universe of a static gravitational field and the corresponding to it metrically inhomogeneous (non-uniform) scale of matter's proper time (which really do not correspond to the undoubted eternity of the existence of the Universe and ensure that the radial velocities of motion of distant galaxies do not exceed the values of the false coordinate velocities of light of the GR) does not ensure not only the gravitational-relativistic invariance of thermodynamic parameters and potentials of matter, but also the true general covariance of all physical laws. And therefore, only in the case of the joint use in the Universe of a physically and metrically homogeneous (non-exponential) scale of the unified gravithermodynamic time and a dynamic gravitational field, which ensure the invariance in space and time of the vacuum velocity of light and the Hubble constant, is it possible to ensure not only the true general covariance of all physical laws, but also the gravitational-relativistic invariance of the thermodynamic parameters and potentials of matter.

From this, for conventionally empty space $(ab = 1)$ we have:

$$d\tau_t = -\frac{H_E\ r_t(1 - r_{ge}/r)^{-1/2} dr_t}{c^2(1 - r_{ge}'/r_t) - H_E^2 r_t^2} = \\ = \frac{r_t^{5/2}\left(r_t - r_{ge}\right)^{-1/2} dr_t}{H_E\left(r_t - r_c\right)\left(r_t - r_s\right)\left(r_t + r_c + r_s\right)}, \qquad (15)$$

where: $r_s = \left\{\sqrt{(r_c + 3r_{ge})/(r_c - r_{ge})} - 1\right\} r_c / 2$ (13) is Schwarzschild sphere radius.

After integrating (15), we'll receive formula for difference $\Delta\tau_{ij} = \tau_{tj} - \tau_{ti}$ between cosmological ages of events, simultaneous in FR of evolutionally self-contracting physical body, in optional points j and i $(r_j > r_i)$ of intrinsic conventionally empty space of this body:

$$\Delta\tau_{ij} = \frac{2}{\widetilde{H}_E}\left\{\ln\left|\frac{\sqrt{r_j} + \sqrt{r_j - r_{ge}}}{\sqrt{r_i} + \sqrt{r_i - r_{ge}}}\right| - \frac{\left(r_c + r_s\right)^{5/2}}{\left(2r_c + r_s\right)\left(r_c + 2r_s\right)\sqrt{r_c + r_s + r_{ge}}} \times \right.$$

$$\times \ln\left|\frac{\sqrt{r_i + r_c + r_s}\left[\sqrt{r_j\left(r_c + r_s + r_{ge}\right)} + \sqrt{\left(r_c + r_s\right)\left(r_j - r_{ge}\right)}\right]}{\sqrt{r_j + r_c + r_s}\left[\sqrt{r_i\left(r_c + r_s + r_{ge}\right)} + \sqrt{\left(r_c + r_s\right)\left(r_i - r_{ge}\right)}\right]}\right| +$$

$$\left. + \frac{r_s^{5/2}}{\left(r_c - r_s\right)\left(r_c + 2r_s\right)\sqrt{r_s - r_{ge}}} \times \ln\left|\frac{\sqrt{r_i - r_s}\left[\sqrt{r_j\left(r_s - r_{ge}\right)} + \sqrt{r_s\left(r_j - r_{ge}\right)}\right]}{\sqrt{r_j - r_s}\left[\sqrt{r_i\left(r_s - r_{ge}\right)} + \sqrt{r_s\left(r_i - r_{ge}\right)}\right]}\right| -$$

$$-\frac{\sqrt{r_c\left(r_c-r_{ge}\right)}}{\left(2r_c-3r_{ge}\right)}\ln\left|\frac{\sqrt{r_c-r_i}\left[\sqrt{r_j\left(r_c-r_{ge}\right)}+\sqrt{r_c\left(r_j-r_{ge}\right)}\right]}{\sqrt{r_c-r_j}\left[\sqrt{r_i\left(r_c-r_{ge}\right)}+\sqrt{r_c\left(r_i-r_{ge}\right)}\right]}\right|\Bigg\}, \quad (16)$$

where $\tilde{H}_E = H_E$ when $\partial r/\partial R > 0$ and $\tilde{H}_E = -H_E$ when $\partial r/\partial R < 0$.

According to (16), for any values of r_{ge}, and, thus, for any values of body mass, events in points of observer horizon of intrinsic space of this body took place in cosmological time in infinitely far past (when $\partial r/\partial R > 0$ and $r_j = r_c : \Delta\tau_{ij} = -\infty$). And this means, that observer horizon of any evolutionally contracting body, as it was shown in, covers all infinite absolute space (according to (8) and (16) when $t = \mathbf{const}$: $R_c = \infty$) [18,43]. Higher concentration of astronomical objects near observer horizon, caused by this, and finiteness of intrinsic space of physical body, however, are not being observed in the process of astronomical observations. This is connected with determination of distances to distant stars by their luminosity, starting from assumption about isotropy of their brightness (which is valid, of course, for Euclidean absolute space, but not for intrinsic space of matter, which has curvature), and directly by their concentration in certain solid angle. But it means, that in fact not metrical radial distances $\hat{r}$ to distant objects in finite non-Euclidean metrical intrinsic space of body, from surface of which observation is taking place, but continuously renormalized radial distances $\breve{r}_k \equiv R_k$ to these objects in infinite Euclidean absolute space are being determined.

Simultaneity in matter FR of infinitely far past on observer horizon (when distances between interacting elementary quasiparticles of protomatter in absolute space were as long as desired) with every concrete event in any point of matter intrinsic space causes the finiteness of metrical distance in intrinsic space to its observer horizon (the possibility of this was shown earlier by Penrose) [18,43,46]. The fact, that observer horizon covers all infinite absolute space explains impossibility for radiation to reach this horizon and to come from horizon to observer within as long as desired but finite time interval. When $r_j = r_c$: $\Delta t_{cij} = \infty$, because for conventionally empty space:

$$\Delta t_{cij} = \int_{\hat{r}_i}^{\hat{r}_j}\frac{d\hat{r}}{v_l} = \frac{1}{c}\int_{r_i}^{r_j}\sqrt{\frac{a}{b}}dr = \int_{r_i}^{r_j}\frac{cH_E^{-2}rdr}{\left(r_c-r\right)\left(r-r_s\right)\left(r+r_c+r_s\right)} =$$

$$= \frac{cH_E^{-2}r_c}{\left(2r_c+r_s\right)\left(r_c-r_s\right)}\ln\frac{\left(r_c-r_i\right)}{\left(r_c-r_j\right)} +$$

$$+ \frac{cH_E^{-2}r_s}{\left(r_c+2r_s\right)\left(r_c-r_s\right)}\ln\frac{\left(r_j-r_s\right)}{\left(r_i-r_s\right)} +$$

$$+ \frac{\left(r_c+r_s\right)}{\left(r_c+2r_s\right)\left(2r_c+r_s\right)}\ln\frac{\left(r_j+r_c+r_s\right)}{\left(r_i+r_c+r_s\right)}. \quad (17)$$

Therefore, near the observer horizon of any body the delayed (by the clock of the body) process of origination of matter is continuously "observed", which corresponds to Gold-Bondi-Hoyl theory only formally [2,21]. If observer horizon of matter intrinsic space is in fact a pseudo-horizon of past, then Schwarzschild sphere, according to (16) and (17), is a pseudo-horizon of future of matter. Events, which take place on this sphere, are simultaneous in physical body FR with every event on the surface and in any other points of this body. Therefore, they can take place in cosmological time only in infinitely far future (when $\tilde{m}_e \to \infty$ and $\Delta t_{cij} = \infty$). There is nothing inside the "fictive" Schwarzschild sphere in that "moment" of cosmological time, and thus, in any moment of intrinsic time of physical body, because, according to (16) and (8), when $t = \mathbf{const}$ and $r_i = r_s$: $\Delta\tau_{js} = \tau_s - \tau_{kj} = \infty$, and $R_s = 0$ (and thus $\hat{r}_s = 0$, despite value of r_s is nonzero). This, of course, is connected with principal conservation of finite eigenvalues of matter dimensions, when its dimensions are as large as desired or as small as desired (hypothetically – conventionally "zero" in infinitely far future) in absolute space, and, thus, with the fact that luminosity radius in principle can't obtain (analogously to absolute temperature) not only infinitely large value but also zero value.

The presence of negative feedback between eigenvalue of dimension (stabilizable output parameter) and length unit, which is being determined in absolute space by the material length standard, becomes apparent here. This negative feedback prevent from catastrophical decrease not only intrinsic dimensions of self-cooling astronomical objects, but also rates of physical processes in matter (which is possible because of the decrease of value of the velocity of light) and, thus, guarantees the stable existence of matter. Moreover it causes the self-organization and stable existence of spiral-wave structural elements (matter elementary quasiparticles) in physical vacuum, which gauge-evolves (becomes older) and is the pseudodissipative medium in CFREU[2].

Analogous phenomena take place in thermodynamics (Le Chatelier – Brown principle), in electromagnetic phenomena (Lenz rule) and in the process of motion (relativistic shrinkage of length) [44]. The character of any physical law or phenomenon is being determined by the presence of explicit and implicit (hidden from observation in principle) negative feedbacks, which are formed between parameters and characteristics of matter in the process of its self-organization and are aimed at the maintaining of stability of steady phase state of matter. Revelation of global topology of direct communications and feedbacks between parameters and characteristics of matter is the supreme aim of physics.

The postulation of Universe stationarity in CFREU (as well as in Gold-Bondi-Hoyl theory) causes principal impossibility of finiteness of its cosmological age in future, as well as in the past. Thus the possibility of birth of Universe from "nothing" and its expansion into "nowhere" is excluded. Conception of Big Bang of Universe is based on using in cosmology instead of metrically homogeneous scale exponential scale of cosmological time $\breve{t} = \breve{t}_k - (1/H_E)\left[1-\exp\left\{H_E\left(t-t_k\right)\right\}\right]$, which requires mutually proportional continuous renormalization of all time intervals and is inverse to physically homogeneous time scale in CFREU. If by the last in any moment of time $\tilde{\tau}_k$ singularity will be realized in future after the same time interval $\tilde{\tau} - \tilde{\tau}_k = H_E^{-1}$, then by it in any moment

of time $\breve{t}_k$ singularity distanced from present into past for the same time interval $\breve{t} - \breve{t}_k = -H_E^{-1}$, invariant only due to its renormalization[3].

Because of this, such conception substitutes infinitely long evolutional development of the Universe by revolutionary event, which took place "not known where and not known inside of what". Rejection of it, however, doesn't deny the possibility of hot condition of matter at early evolutional stages and other results in Universe evolution research, achieved by cosmology (only some remaking sense of this results is required). Moreover, this rejection leads only to metrical transformations of STC, which have no influence on sequence of cause and effect in evolutional physical processes.

According to physical notions stated here, exponential slowing down of all physical processes by used now in cosmology time scale is provided. Thus, exponential slowing down of matter self-contraction in the fundamental (Newton-Weyl absolute) space is provided too. And this is equal to exponentially quick Universe expansion in FR, comoving with matter. Therefore, these notions are in good agreement with inflationary cosmology, based on the scenario of inflatory Universe [22].

Despite this, use of metrically inhomogeneous exponential time scale in cosmology in most cases may be expedient, the same as the use of metrically inhomogeneous logarithmical time scale in physics sometimes. But we must remember, that cosmological singularity, born in this case, is fictive.

7. Black Holes and Astronomical Objects, Which Are Alternative to Them

According to (2), during the setting up of physical, and so metrical, singularities on the surface of the body ($1/a_e = b_e = 0$): the following condition takes place: $b_e' = [1 - 3(H_E r_e / c)]/r_e > 0$. Therefore, when values of functions $a(\bar{r})$ and $b(\bar{r})$ are nonnegative the value of luminosity radius mustn't decrease ($\partial r / \partial \bar{r} \le 0$) in case of advance from the surface of the body to its center. The change of signature of linear element ($a \le 0$ and $b \le 0$) is not examined here, because it doesn't correspond to primordially accepted in GR physical notions about space and time.

However, monotone decreasing $(\partial r / \partial \bar{r} < 0)$ of function $r(\bar{r})$ in the layer near surface is also impossible. Since if it were possible, gravitational forces would be directed from within of ideal liquid to its surface $(db / d\bar{r} < 0)$ and would be balanced by no other force, because of conventionally zero value of pressure above this surface. And furthermore, by the same reason, physical singularity can't arise on the surface of body before it is set up in the whole its volume. Therefore, in intrinsic space of such body its sphero-cylindrical metrics ($\partial r / \partial \bar{r} = 0$ when $\hat{r} \le \hat{r}_e$), which guarantees the possibility of propagation of physical singularity in the whole body volume ($b(\bar{r}) = 0$ when $\hat{r} \le \hat{r}_e$), must be formed.

According to (14), and taking into account $a_{\min} > 1$, let's find lower limit of values of difference between cosmological ages of simultaneous events in nonempty space of any physical body, and so, inside of examined by us ideal liquid:

$$|\Delta\tau_{ij}| > \left| \frac{H_e}{c} \int_{r_i}^{r_j} \sqrt{\frac{a_{\min}}{b_{\max}\left(c^2 b_{\max} + H_E^2 r_t^2\right)}}\, r_t dr_t \right| >$$

$$> \left| \sqrt{c^2 b_{\max} + H_E^2 r_j^2} - \sqrt{c^2 b_{\max} + H_E^2 r_i^2} \right| / (c H_E \sqrt{b_{\max}}) . \quad (18)$$

According to obtained relation, condition $|\Delta\tau_{ij}| \ne \infty$ for as small as desired values of $\Delta\hat{r}_{ij}$ is fulfilled when $b(\bar{r}) = 0$ and also only in case of presence of sphero-cylindrical metrics of internal intrinsic body space. From all these follows the absence of both gravitation inside such "body" and radial pressure drop $(d\tilde{p} / d\bar{r} = 0)$ in its "matter", elementary quasiparticles of which, because of equality of their Hamiltonians to zero, have radiated all their energy with quasiparticles and, therefore, have proceeded from actual state into virtual and in fact have destroyed themselves (for external observer). Energy of such "dead" black hole is concentrated only in electromagnetic radiation, which propagates in CFREU at Hubble velocity. And, therefore, only "dead" black hole can correspond to GR gravitational field equations if values of functions $a(\bar{r})$ and $b(\bar{r})$ are nonnegative.

Let's examine also compatibility of existence of black holes with presence of CFREU. The observer horizon of rigid body in its internal (intrinsic) FR is motionless ($v_{Hc} = 0$). However, it moves in CFREU at the velocity of light. Therefore, matter, which has inertia, can't be on this horizon in principle. There necessarily must be a layer of empty space between the surface of the body and its external event horizon (which, as it was shown before, is a pseudo-horizon of past). But, according to (8) and (16) any as "photometrically" thin as desired layer ($r_c - r_e \to 0$ in sprite of the fact that $\hat{r}_c - \hat{r}_e >> 0$) of external conventionally empty part of intrinsic space of physical body contains whole Universe. In other words, both on and outside event horizon of as massive as desired physical body no other physical objects can be in principle. Ultralow gravitational field strength, which is created near its event horizon by astronomical body with as small as desired mass, doesn't prevent other astronomical objects near this horizon from spontaneous motion near this horizon. And, if event horizon of body is "passing by" these astronomical objects in fundamental space, then in intrinsic space of this body the distancing of these objects from observer at velocity of light would be observed. Therefore, no physical body can be self-isolated from Universe by singular surface, which is located in empty space or at least contacts with this space.

So, according to physical notions taken here, such hypothetic astronomical objects as black holes can't exist in principle. Impossibility of motion of surface of evolutionally self-contracting in absolute space astronomical body at velocity of light in this space is imposing substantial restriction both on the value of luminosity radius of this surface in intrinsic space and on the value of body gravitational radius. So, for example, velocity of light on the surface of hypothetical absolutely incontractable ideal liquid, in whole volume of which both eigenvalues of mass density

$\tilde{\mu} = \mathbf{const}(\tilde{r})$ and, according to (1), improper values of enthalpy density $\sigma = \tilde{\sigma}\sqrt{b} = (\tilde{\mu}c^2 + \tilde{p})\sqrt{b} = \tilde{\mu}c^2\sqrt{b_e} = \mathbf{const}(r)$ are constant, when $r_0 = 0$ is the following:

$$v_{le}/c \equiv \sqrt{b_e} = \sqrt{1-(\kappa\tilde{\mu}c^2+\Lambda)r_e^2/3} = \\ = 1-(2/3)(1+\Lambda/\kappa\tilde{\mu}c^2)(1-\sqrt{b_0}).$$

It takes on minimal value $(v_{le})_{\min} = (1-2\Lambda/\kappa\tilde{\mu}c^2)/3$ for the maximal value of surface radius: $(r_e)_{\max} = 2\sqrt{(2\kappa\tilde{\mu}c^2-\Lambda)/3}/\kappa\tilde{\mu}c^2$, for which gravitational singularity originates ($\tilde{p}_0 = \infty$; $a_0 \cdot b_0 = 0$) in the center of gravity of the liquid. Further growth of r_e, and so growth of liquid mass for such (normal: $a_0 = 1$) configuration of its STC, is impossible in principle, because it leads to negative values of not only b_0, but also $\tilde{p}_0$ and $\tilde{\sigma}_0$. And furthermore, when $\tilde{\mu} = 6H_E^2/\kappa c^4$: $r_e = r_s = r_c = \Lambda^{-1/2} = c/\sqrt{3}H_E$. Thus, intrinsic space of liquid (both inside and outside it) has sphero-cylindrical metrics. And limit velocity of matter v_l not only inside the liquid, but also in conventionally empty space above it, takes on a zero value.

Like in all other solutions of equation (3), in this solution integration begins only from zero value of luminosity radius of body. Therefore, upper layers of matter (even when they're as massive as desired) have no direct effect on the curvature of intrinsic space of body in lower layers of matter, while lower layers of matter have direct effect on the curvature of this space in upper layers. For hypothetic absolutely incontractable liquid function $a(\tilde{r})$, which determines curvature of its intrinsic space, in the points of lower liquid layers doesn't depend on the presence of liquid higher than these layers at all. In fact, the pressure of upper layers of absolutely incontractable liquid has no effect on distribution of eigenvalue of its density in lower layers. This is not only a paradox, but not always may be a physical reality. Upper layers of matter, when their mass is very big, must have direct effect on curvature of the space of body in lower layers via some integral characteristics. According to (3), this is possible if in intrinsic spaces of very massive astronomical bodies physically realized values of luminosity radius are limited not only from the top ($r_{\max} \equiv r_c \neq \infty$), but also from the bottom ($r_{\min} \equiv r_0 \neq 0$). This limitation from the bottom of value of luminosity radius of body with strong gravitation field may be connected with existence of metrical singularity ($a_0 = \infty$) inside of body. It takes place in the case of non-monotone radial change of gravitational field strength in absolute and co-moving spaces. For such spatial distribution of gravitational field strength with decreasing of value of metrical radial distance $\tilde{r}$ luminosity radius r at first decreases ($\partial r/\partial\tilde{r} > 0$) to its minimal value r_0, and then begins to increase ($\partial r/\partial\tilde{r} < 0$) inside nonempty intrinsic space of this body. Physical singularity ($b(r_0) = 0$), which, according to (5), always accompanies metrical singularity, will take place only in infinitely small neighbourhood of the surface with luminosity radius r_0. Therefore, it can be expected that this singularity will be smeared by quantum fluctuations of inhomogeneous structure of STC. In this case it doesn't completely disturb the interaction between matter of internal and external parts of such body, due to possibility of tunnelling of formally absolutely thin barrier, formed by it. According to quantum-mechanic notions, the motion of matter is not its mechanic transposition, but quasi-continuous change of its space-time states. Therefore, such singular surface can't be an absolutely insuperable barrier for penetration of matter through it.

8. Internal Solution of GR Equations for Ideal Liquid in CFREU

Due to covariance of GR gravitational field equations, their internal solution for ideal liquid may be received also in CFREU. In this FR nonzero components of metrical tensor are the following:

$$g_{11} = N_E^2(R,\tau) = r^2(R,\tau)/R^2, \quad g_{22} = r^2(R,\tau), \\ g_{33} = r^2(R,\tau)\sin^2\theta, \\ g_{44} = -f_G^2(R,\tau)\Gamma_E^2(R,\tau)\eta_m^{-2}c^2 = -f_{Gb}^2(R,\tau)\eta_m^{-2}c^2 = \\ = -N_E^2(R,\tau)q_N^2(R,\tau)\eta_m^{-2} = -N_E^2(R,\tau)v_{cb}^2(R,\tau).$$

Here eigenvalue of radial coordinate $r(R,\tau)$ is determined by intrinsic length standard in world point with following absolute coordinates and is identical to the value of luminosity radius in intrinsic FR of the liquid. Relation $N(R,\tau) = r/R$ determines inequality of dimensions of identical matter objects in different points of Euclidean space of CFREU, and, therefore, characterizes metrical (scale) inhomogeneity of this space for matter. Average statistical relative value of frequency of interaction of matter elementary quasiparticles $f(R,\tau) = NV_l/c$ determines inequality of rates of identical physical processes in different points of CFREU space, and, therefore, characterizes physical inhomogeneity of CFREU space for matter[4].

According to this, gravitational field equations for ideal liquid [10]:

$$M_i^k = G_i^k - Gg_i^k/2 - \Lambda g_i^k = -\kappa T_i^k = -(\kappa/V)[(c^{-2}W_0)U_iU^k + (W_0 - E_0)\delta_i^k] = \\ = -\frac{\kappa}{V}\left[\left(\frac{m_{00}f_G}{\eta_m} - \frac{p_NV_N}{c^2} + \frac{T_NS_N}{c^2}\right)U_iU^k + (T_NS_N - p_NV_N)\delta_i^k\right] = \\ = -\frac{\kappa m_{00}}{V}\left[\frac{\eta_m}{f_G}U_iU^k + c^2\left(\frac{\eta_m}{f_G} - \frac{f_G}{\eta_m}\right)\delta_i^k\right] = -\kappa\mu_{00}\left[\frac{1}{\sqrt{b}}U_iU^k + c^2\left(\frac{1}{\sqrt{b}} - \sqrt{b}\right)\delta_i^k\right]$$

in pseudo-Euclidean Minkowski space of CFREU will have the following form:

$$M_1^1 = -\frac{2R^2}{r^3f_{Gb}}\frac{\partial f_{Gb}}{\partial R}\frac{\partial r}{\partial R} - \frac{2\eta_m^2}{rc^2f_{Gb}^3}\frac{\partial f_{Gb}}{\partial\tau}\frac{\partial r}{\partial\tau} + \frac{2\eta_m^2}{rc^2f_{Gb}^2}\frac{\partial^2 r}{\partial\tau^2} + \frac{\eta_m^2}{r^2c^2f_{Gb}^2}\left(\frac{\partial r}{\partial\tau}\right)^2 - \frac{R^2}{r^4}\left(\frac{\partial r}{\partial R}\right)^2 + \\ + \frac{1}{r^2} - \Lambda = -\frac{\kappa}{V}\left[(T_NS_N - p_NV_N) - \frac{W_0v_b^2}{v_{lb}^2 - v_b^2}\right] = -\frac{\kappa m_{00}c^2}{V}\left[\frac{\eta_m}{f_{Gb}} - \frac{f_{Gb}}{\eta_m} - \frac{\eta_m v_b^2}{f_{Gb}(v_{lb}^2 - v_b^2)}\right],$$

$$M_1^4 = \frac{r^2\eta_m^2}{R^2c^2f_{Gb}^2}M_4^1 = \frac{2\eta_m^2}{rc^2f_{Gb}^2}\left[\frac{1}{f_{Gb}}\frac{\partial f_{Gb}}{\partial R}\frac{\partial r}{\partial\tau} + \frac{1}{r}\frac{\partial r}{\partial R}\frac{\partial r}{\partial\tau} - \frac{\partial^2 r}{\partial R\partial\tau}\right] = -\frac{\kappa\eta_m^2 m_{00}cv_{lb}v_br}{f_G^2RV(v_{lb}^2 - v_b^2)} = -\frac{\kappa\mu_{00}v_{lb}v_br^3}{cb^3R^3},$$

$$M_3^3 = M_2^2 = -\frac{R^2}{r^2f_{Gb}}\frac{\partial^2 f_{Gb}}{\partial R^2} - \frac{R}{r^2f_{Gb}}\frac{\partial f_{Gb}}{\partial R} - \frac{2\eta_m^2}{rc^2f_{Gb}^3}\frac{\partial f_{Gb}}{\partial\tau}\frac{\partial r}{\partial\tau} + \frac{2\eta_m^2}{rc^2f_{Gb}^2}\frac{\partial^2 r}{\partial\tau^2} + \frac{\eta_m^2}{r^2c^2f_{Gb}^2}\left(\frac{\partial r}{\partial\tau}\right)^2 - \frac{R^2}{r^3}\frac{\partial^2 r}{\partial R^2} + \\ + \frac{R^2}{r^4}\left(\frac{\partial r}{\partial R}\right)^2 - \frac{R}{r^3}\frac{\partial r}{\partial R} - \Lambda = -\frac{\kappa m_0c^2}{V}\left(\frac{\eta_m}{f_{Gb}} - \frac{f_{Gb}}{\eta_m}\right) = \frac{\kappa}{V}(T_NS_N - p_NV_N) = -\kappa\mu_{00}c^2\left(\frac{1}{\sqrt{b}} - \sqrt{b}\right) = -\kappa\mu_{gr0}c^2(1-b),$$

$$M_4^4=\frac{3\eta_m^2}{r^2c^2f_{Gb}^2}\left(\frac{\partial r}{\partial\tau}\right)^2-\frac{2R^2}{r^3}\frac{\partial^2 r}{\partial R^2}+\frac{R^2}{r^4}\left(\frac{\partial r}{\partial R}\right)^2-\frac{2R}{r^3}\frac{\partial r}{\partial R}+\frac{1}{r^2}-\Lambda=\frac{\kappa}{V}\left[\frac{W_0v_{lb}^2}{v_{lb}^2-v_b^2}-(T_NS_N-p_NV_N)\right]=$$

$$=\frac{\kappa m_{00}c^2}{V}\left[\frac{f_{Gb}}{\eta_m}-\frac{\eta_m}{f_{Gb}}+\frac{\eta_m v_{lb}^2}{f_{Gb}(v_{lb}^2-v_b^2)}\right]=\frac{\kappa m_{00}c^2}{V}\left[\sqrt{b}-\frac{1}{\sqrt{b}}+\frac{\sqrt{b}}{b-v_b^2c^{-2}}\right],$$

where: $W_0=\frac{\eta_m m_{00}c^2}{f_G}=\frac{m_{00}c^2}{\sqrt{b}}=\frac{m_{in0}c^2}{b}=m_{gr0}c^2=E_0-p_NV_N+T_NS_N$ and $E_0=m_{00}c^2f_G/\eta_m=m_{00}c^2\sqrt{b}=m_{in0}c^2$ are the gravitational intranuclear energy (ordinary rest energy) and the inert free intranuclear energy of matter correspondingly; $T_NS_N-p_NV_N=m_{00}c^2(1/\sqrt{b}-\sqrt{b})=c^2(m_{gr0}-m_{in0})$; $\Lambda=3H_E^2c^{-2}$ is the cosmological constant;

$$v_b=dR/d\tau=-H_ER=-\sqrt{\Lambda/3}cR=\breve{v}_b/N_E=\breve{v}_bv_{lb}/c \text{ i } \hat{v}_b \quad (19)$$

are the velocities of radial motion of micro-objects of matter in CFREU, which are determined in cosmological time τ by the united length standard and by their own length standards correspondingly; $\breve{v}_b=cv_b/v_{lb}=-rc\sqrt{\Lambda/3}\eta_m/f_G=\mathbf{const}(\tau)$ is the relative velocity of radial motion of micro-objects of matter;

$v_{lb}=(R/r)\sqrt{v_l^2+\Lambda r^2c^2/3}=\sqrt{bc^2+H_E^2r^2}/N_E$ and v_l are the limit velocities of individual motion of definite substance (or the limit velocities of group motion of many substances) in cosmological time and in intrinsic time of matter correspondingly; $f_{Gb}=\sqrt{f_G^2+\Lambda\eta_m^2r^2/3}=\eta_m\sqrt{b+H_E^2c^{-2}r^2}$ and $f_G=\eta_m\sqrt{b}$ are the frequencies of intranuclear interaction in cosmological time and in intrinsic time of matter correspondingly.

From these equations, taking into account (9,12,14) and rigidity of intrinsic FR of ideal liquid ($r=\mathbf{const}(\tau)$, $f(r)=\mathbf{const}(\tau)$, $\tilde{\mu}(r)=\mathbf{const}(\tau)$, $\tilde{p}(r)=\mathbf{const}(\tau)$) we find by the metrically homogeneous scale of cosmological time τ ($d\tau\equiv dt=d\tilde{t}/\sqrt{b}$ when $dr=0$) following dependences:

$$\left(\frac{\partial r}{\partial\tau}\right)_R=H_ER\left(\frac{\partial r}{\partial R}\right)_\tau=\frac{\tilde{H}_Er}{\sqrt{a(1-v_b^2v_{lb}^{-2})}}=\frac{\tilde{H}_Ef_{Gb}}{\eta_m\sqrt{ab}},$$

$$\sqrt{b}=\frac{v_l}{c}=\frac{f_G}{\eta_m}=\frac{1}{\sqrt{a}}\left(1+\frac{\kappa m_{00}c^2}{2}\int_{r_e}^{r}\frac{a^{3/2}r}{V}dr\right),$$

$$\tau(r,t)=\tau_k+(t-t_k)-\frac{\tilde{H}_E}{c^2}\int_{r_k}^{r}\sqrt{\frac{a}{b}}\frac{\eta_m r}{f_{Gb}}dr,$$

$$f=\sqrt{b+\Lambda\frac{r^2}{3}}=\sqrt{\frac{1}{a}\exp\int_{r_e}^{r}\kappa\left(\tilde{\mu}c^2+\tilde{p}\right)ardr+H_E^2\frac{r^2}{c^2}},$$

and directly when $1/a_0=0$:

$$\frac{1}{a}=\frac{1}{r}\left[(r-r_0)-\kappa c^2\int_{r_0}^{r}r^2\tilde{\mu}dr-\frac{H_E^2}{c^2}\left(r^3-r_0^3\right)\right],$$

$$\tau(r,t)=\tau_k+\frac{(\tilde{t}-\tilde{t}_k)}{\sqrt{b}}-\frac{\tilde{H}_e}{c^2}\int_{r_k}^{r}\sqrt{\frac{a}{b}}\frac{r}{f}dr=\tau_k+(t-t_k)-\frac{\tilde{H}_e}{c^2}\int_{r_k}^{r}\sqrt{\frac{a}{b}}\frac{r}{f}dr, \quad (20)$$

$$R(r,t)_{RGTD}=R(r,\tau_k)\exp[H_E(\tau_k-\tau)]=r_k\exp\left[H_E\left((\tau_k-\tau)+\frac{\eta_m}{\tilde{H}_E}\int_{r_k}^{r}\frac{\sqrt{ab}}{f_{Gb}r}dr\right)\right],$$

$$R(r,t)_{RGTD}=r_k\exp\left[H_E\left((t_k-t)+\frac{1}{\tilde{H}_E\eta_m}\int_{r_k}^{r}\sqrt{\frac{a}{b}}\frac{f_{Gb}}{r}dr\right)\right]=$$

$$=r_k\exp\left[H_E\left((t_k-t)+\frac{1}{\tilde{H}_E}\int_{r_k}^{r}\frac{\sqrt{a}}{\sqrt{1-v_b^2v_{lb}^{-2}}r}dr\right)\right]. \quad (21)$$

Limiting minimal value of luminosity radius r_0 corresponds here to spherical surface, in the points of which there is no gravitational field strength ($db/d\bar{r}\equiv b_0'/\sqrt{a_0}=0$), and the following conditions are fulfilled: $f_0=H_Er_0/c$, $V_{l0}=H_ER_0$. The values t_k and $\tilde{t}_k=\sqrt{b}t_k$ of the moment of time, in which in the point with radius r_k (separately for $R_k>R_0(\tau_k)$ and for $R_k<R_0(\tau_k)$) dimension of length standard is calibrated in CFREU by its dimension in co-moving FR ($R(r_k,\tau_k)\equiv R(r_k,t_k)\equiv r_k$), are determined correspondingly in astronomical intrinsic time (common for whole liquid) and in proper quantum time of the point with radius r_k. In these relations $\tilde{H}_E=H_E$ for the region of CFREU space $R\in(R_0;\infty)$, in which $\partial r/\partial\bar{r}>0$, and $\tilde{H}_E=-H_E$ for the region $R\in(0;R_0)$, in which $\partial r/\partial\bar{r}<0$.

In spite of the fact that $db/d\bar{r}=0$ when $r=r_0$, the value of db/dr is nonzero ($b_0'\neq0$). This is caused by the fact that, according to (5), $a_0b_0\neq0$. Therefore, according to (2), $\tilde{p}_0\neq\infty$, even if the value of the mass of liquid is as large as desired, but finite. And so for compact astronomical formations the value of $r_0<<(\Lambda-\kappa\tilde{p}_0)^{-1/2}$ may be guaranteed.

Because of presence of principal possibility of function $R(r)$ two-valuedness in this internal solution (the same as in external solution), function $\bar{r}(r)$ may also be two-valued. This means, that GR gravitational field equations really admit the possibility of existence of metrical singularity ($a_0=\infty$) inside physical body [16]. Thus, according to (21), in any moments of cosmological and intrinsic time of matter they guarantee correspondence of eigenvalues of luminosity radius r, not smaller than r_0 ($r\geq r_0>r_{ge}$), to whole infinite Euclidean space of CFREU $R\in(0;\infty)$. Therefore, no region of CFREU space can correspond to Schwarzschild solution for $r<r_{ge}$, when $a\leq0$ and $b\leq0$ [7]. At the same time, both in external ($R>R_0$) and internal ($R<R_0$) conventionally empty intrinsic spaces of liquid velocity of motionless in CFREU objects is determined by Hubble relation:

$$v_H=\tilde{H}_Er\sqrt{1-\frac{V_e^2}{V_l^2}}=\tilde{H}_Er\sqrt{1-\frac{r^3(r_c-r_{ge})}{r_c^3(r-r_{ge})}}.$$

9. Extraordinary Configuration of STC, Which Guarantees the Presence of Minimum of Total Enthalpy of the Whole Ideal Liquid

Such singular solution of GR gravitational field equations corresponds to hollow spherically symmetrical body with mirror symmetrical intrinsic space and many centers of gravity $(db/d\bar{r}=0)$ in the points of median singular surface, which is concentric to external and internal boundary body surfaces. When $\Lambda=0$ such configuration of intrinsic space consists of two asymptotically Euclidean half-spaces, connected by narrow gullet. This configuration is obtained by Fuller and Wheeler, being based on geometrodynamic model of mass [53,54]. When $\Lambda\neq 0$, internal empty space of massive astronomical body is limited by fictive sphere of the pseudo-horizon of future. In this internal empty space, which is as it were «turned inside-out» by very strong gravitational field, instead of the Universe expansion phenomenon, phenomenon of contraction of "internal universe" is "observed" and also internal planet system may be formed. In intrinsic FRs of these planets internal boundary surface of this astronomical body will be observed as convex (the same as external boundary surface). This is because of the fact that luminosity radiuses of their orbits will be longer than luminosity radius of this surface. Only absence of distant stellar systems in internal empty space will give the opportunity to differ it from external space.

The value of luminosity radius in the center of gravity is determined unambiguously, if the configuration of STC of liquid is ordinary ($r_0=0$ when $a_0=1$), and becomes indeterminate from GR equations, if the configuration is extraordinary $(a_0=\infty)$. Because of this, one should agree with the statement of Hawking [5]: "GR itself (without use of additional laws, obtained in classical physics) doesn't provide field equations with boundary conditions in singular points. And, therefore, it becomes incomplete near these points."

Absolute stability of thermodynamic equilibrium condition of matter, which is held by gravitational field and is self-contracting in CFREU as whole, may be guaranteed in case of invariability of entropy and external pressure only when the following condition is fulfilled. Spatial distribution of function $r(\bar{r})$ must correspond to the minimum of Lagrangian of enthalpy of whole matter of liquid body in CFREU. This value of Lagrangian is equal to enthalpy of liquid in FR, comoving with it, and is determined in following way:

$$E_e(r_0,r_e)=4\pi\int\limits_{R_{\min}}^{R_{\max}}\sigma N^3R^2\left(1-V^2/V_c^2\right)^{-1/2}dR=$$

$$=4\pi\int\limits_{R_{\min}}^{R_{\max}}\tilde{\sigma}fN^3R^2dR=4\pi n\int\limits_{r_0}^{r_e}\left(\tilde{\mu}c^2+\tilde{p}\right)\sqrt{ab}r^2dr\,. \qquad (22)$$

For concrete permanent quantity of homogeneous matter of liquid (eigenvalue of mass:

$$\tilde{m}_e=4\pi n\int\limits_0^{\bar{r}_e}\tilde{\mu}r^2d\bar{r}=4\pi n\int\limits_{r_0}^{r_e}\tilde{\mu}\sqrt{a}r^2dr \qquad (23)$$

of whole body) this is being realized:

$$\frac{dE_e}{dr_0}=\frac{\partial E_e}{\partial r_0}+\frac{\partial E_e}{\partial r_e}\frac{dr_e}{dr_0}=\frac{\partial E_e}{\partial r_0}-\left(\frac{\partial E_e}{\partial r_e}\frac{\partial\tilde{m}_e}{\partial r_0}\right)\left(\frac{\partial\tilde{m}_e}{\partial r_e}\right)^{-1}=0$$

in case of fulfillment of the following condition:

$$r_0^2=\lim_{r_i\to r_0}\left\{\frac{\sqrt{a_e}}{\sqrt{a(r_i)}}\int\limits_{r_i}^{r_e}\left[\left(\frac{\partial\sigma}{\partial r_0}-\frac{c^2}{\sqrt{a_e}}\frac{\partial\tilde{\mu}}{\partial r_0}\right)+\frac{\left(\sqrt{a_e}\sigma-c^2\tilde{\mu}\right)}{2\sqrt{a_e}a}\frac{\partial a}{\partial r_0}\right]\frac{\sqrt{a}r^2dr}{\sqrt{a_e}\sigma_0-c^2\tilde{\mu}_0}\right\}\geq 0\,, \qquad (24)$$

which takes into account direct influence of both upper and lower matter layers on the values of functions $a(r,r_0)$ and $b(r,r_0)$. Spatial distributions of improper (coordinate) value of enthalpy density $\sigma(r,r_0)$ and eigenvalue of mass density $\tilde{\mu}(r,r_0)$ are obtained via solving both GR gravitational field equations and equations of thermodynamic state of matter. These solutions can be found for solid (when of $n=1$) and for hollow (when $n=2$) spherically symmetrical bodies, due to equality of radial distributions of eigenvalues of physical characteristics of homogeneous ideal liquid in internal and external half-layers of hollow body in its rigid intrinsic FR. In non-rigid intrinsic FR of self-cooling hollow body, which has unequal temperatures of external and internal boundary surfaces, eigenvalues of mass of internal and external half-layers of hollow body will be also unequal. And, therefore, fulfillment of the condition, which takes into account values of these temperatures, will be required instead of the fulfillment of the condition (24). That's why GR should be considered as component part of gravithermodynamics that takes into account additional intensive and extensive parameters, which characterize gauge effect of motion and gravitation on the gravithermodynamical state of matter.

When quantity of matter doesn't exceed its critical value, function $E_e(r_0,r_e)$ doesn't have minimum and zero value of luminosity radius $(r_0=0)$ corresponds to the smallest value of this function. Because of this, physical body can be only solid globular. When mass of astronomical body is close to critical value, solid spherically symmetrical topological form becomes unstable even to small perturbations of gravitational field strength. This may lead to its transformation into hollow spherically symmetrical topological form $(r_0\neq 0)$, which corresponds to minimum of enthalpy of the body and, therefore, is gravitationally absolutely stable. Because of decrease of r_e value, such catastrophic change in body topology may be considered as relativistic gravitational collapse of matter. But in contrast to the black hole, this catastrophic change is not accompanied by matter self-closure inside the sphere of physical singularity $(b_e\equiv 1/a_e>>0)$. Such hollow body (which contains Fuller-Wheeler lost world) at the completion stage of its evolution is alternative to hypothetical black hole. This body is very massive hollow neutron star, which doesn't differ from black hole by external observable features and is the result of smooth cooling down of quasar. Very high values of energy and mass of quasars denote the fact that they have hollow topological form. Quick loss of energy of quasars (due to their huge luminosity) makes their active life short. At the present moment of cosmological time all of them, apparently, proceed to the new forms of their existence. Very long distances to quasars denote this. However, only the small amount of quasars was transformed into hollow neutron stars. Most of quasars were gradually turned into the stars, which can't keep

the stability of hollow topological form in future due to big energy loss. As soon as their energy exceeds the critical value, they are transformed into supernovas. After supernova sheds external layer of its matter, which is surplus for ordinary (not hollow) topological form of star, its evolution continues with new configuration of intrinsic STC. According to (23), and taking into account the fact that eigenvalue of mass density of liquid reaches minimum on its external surface $(\tilde{\mu} \geq \tilde{\mu}_e)$, let's find the lower limit for integral eigenvalue of mass of whole hollow liquid body:

$$\tilde{m}_e > \int_{r_0}^{r_e} \frac{8\pi\tilde{\mu}_e r^{5/2} dr}{\sqrt{(r-r_0) - \kappa c^2 \tilde{\mu}_e \int_{r_0}^{r} r^2 dr - H_E^2 (r^3 - r_0^3) c^{-2}}} >$$

$$> \frac{8\pi\tilde{\mu}_e}{\sqrt{1 - r_0^2 (\kappa c^2 \tilde{\mu}_e + 3H_E^2 c^{-2})}} \int_{r_0}^{r_e} \frac{r^{5/2} dr}{\sqrt{r - r_0}} =$$

$$= \frac{\pi\tilde{\mu}_e \sqrt{r_e (r_e - r_0)}}{\sqrt{1 - r_0^2 (\kappa c^2 \tilde{\mu}_e + 3H_E^2 c^{-2})}} \times$$

$$\times \left[\frac{(8r_e^2 + 10r_e r_0 + 15r_0^2)}{3} + \frac{5r_0^3}{\sqrt{r_e (r_e - r_0)}} \ln\left(\sqrt{\frac{r_e}{r_0}} + \sqrt{\frac{r_e}{r_0} - 1} \right) \right], \qquad (25)$$

where:

$$\sqrt{1 - r_0^2 (\kappa c^2 \tilde{\mu}_e + 3H_E^2 c^{-2})} \geq \sqrt{1 - (r^2 + r_0 r + r_0^2)(\kappa c^2 \tilde{\mu}_e / 3 + H_E^2 c^{-2})}.$$

As it was expected, according to (25), when the value of the relation (r_e / r_0) is as large as desired, hollow spherical body may have as big as desired mass.

The value of enthalpy of ideal absolutely incontractable liquid is:

$$E_e = 4\pi n \sigma \int_{r_0}^{r_e} \sqrt{a} r^2 dr = \tilde{m}_e \sigma / \tilde{\mu}.$$

Therefore, equation (24) transforms into identity, and the value of minimal luminosity radius becomes indeterminate. This shows the degeneracy of such state for ideal liquid. Because of this, equilibrium state of absolutely incontractable liquid will be absolutely stable for any values of r_0. And thus, as large as desired quantity of absolutely incontractable liquid may be contained inside of hollow body, when the value of r_e is as small as desired (when $r_0 \to 0$, according to (25), $\tilde{m}_e \to \infty$). This, of course, is physically unreal, the same as existence of absolutely incontractable liquid. Therefore, such result may be considered as one more sign of degeneracy of state of ideal liquid, and, thus, as apparent confirmation of validity of selected by us criterion for determination of minimally possible value of luminosity radius of body when it has hollow topological form.

10. Conclusion

The singular Schwarzschild sphere, on which only the infinitely distant cosmological future always resides, and the singular sphere of the event (visibility) horizon of the Universe, on which only the infinitely distant cosmological past always resides, are fictitious surfaces, which are formed in the FR of the people's world (FRPW) by the evolutionary process of self-contraction (in the FR comoving with expanding Universe (CFREU)) of spiral-wave self-formations corresponding to non-fictitious elementary quasiparticles of matter. In the solutions of the gravitational field equations in CFREU, these fictitious spheres are absent [10,22]. After all, in the background Euclidean fundamental space of CFREU, the radius of the Schwarzschild sphere is zero, and the radius of the sphere of the event horizon of the Universe is infinity.

The tendency to zero of both the false coordinate velocity of light in the GR and the limit velocity of matter (equivalent to the frequency of electromagnetic interaction of micro-objects of matter) in relativistic gravithermodynamics (RGTD) corresponds to the tendency to infinity of both absolute temperature and pressure [10]. Therefore, almost singular surfaces can be contained only inside matter and separate it from the internal antimatter under the condition of the formation of an extremely massive hollow body with mirror symmetry of its intrinsic space [22,84].

So, avoidance of physical realizability of cosmological singularity in GR is possible. It is necessary and enough for this to postulate the counting of cosmological time in CFREU and not to exclude (the most of physicists agree with this) cosmological Λ-term from gravitational field equations. And thus, it is necessary to admit physical reality of infinitely long gauge process of matter self-contraction in absolute space of CFREU.

Avoidance of physical realizability of gravitational singularity ($\tilde{T}_0 = \infty$; $\tilde{p}_0 = \infty$; $a_0 b_0 = 0$) for very massive astronomical body is also possible. It is necessary and enough for this to supplement gravitational field equations with condition of reaching the minimum of enthalpy of the whole matter of a maximally cooled body and to admit physical reality of mathematically inevitable hollow topological form of body and configuration of STC with "turned inside out" internal half-space, which corresponds to this topology.

Similarly, in the RGTD, for this it is necessary and sufficient to supplement the gravitational field equation of RGTD with the condition of reaching a minimum by the Gibbs free energy (the multiplicative component of which is identical to the ordinary energy of matter and equivalent to its gravitational mass) of all matter of an astronomical object that is naturally cooling.

True general covariance of physical laws takes place in the metrically and physically homogeneous unified gravithermodynamic (universal astronomical) time of the FRPV, which is proportional to the cosmological time of the CFREU and strictly corresponds to the dynamic gravitational field.

After all, the evolutionary self-contraction of matter in the FRPW is gauge and therefore fundamentally unobservable [10,15,22]. In the FRPW, the thing that corresponds to it is the deceptive observation of the expansion of the Universe, which is analogous to the deceptive observation of the rotation of the Sun and the starry sky around the Earth.

That is why, in the FRPW instead of a metrically and physically homogeneous scale, a false exponential scale of astronomical time was introduced, which corresponds to a static gravitational field instead of a dynamic one and thanks to which the Universe supposedly has a finite age. It is in principle possible to switch from this misleading time scale to a metrically homogeneous scale of cosmological time. But then we will have to continuously renormalize both the temporal coordinates of events and the spatial coordinates of astronomical objects (in accordance with the evolutionary decrease in length standards in the CFREU). In addition, in order to describe the motions of stars according to the physical laws known to us, it is now necessary to renormalize even Newton's gravitational "constant" in time and space [20,22].

The fundamental Hubble constant, like the constant of the velocity of light, does not require renormalization. After all, only its fundamental invariance in time ensures the continuity of the spatial continuum in rigid FRs. That is because the Earth has an almost rigid FR. And therefore, the Universe does not need not only false "black holes" and false dark non-baryonic matter, but also the similarly false "dark energy" [10,22].

11. Supplement

The Substantiation of the Possibility of Stable Existence of Antimatter Inside the Hollow Astronomical Body

Equations (19-21) describe only the motion in CFREU of the points of whole matter (ideal liquid) and its intrinsic space, which is rigidly connected with this matter. Free (inertial) motion of the test particles in the hollows inside the liquid or in an empty space above it will depend in CFREU not only on the strength of gravitational forces, which are determined by the metrical tensor of STC of liquid and are proportional to hamiltonians of these particles, but also on the strength:

$$\xi = F_{\partial} / P = -c\left(\Lambda / 3\right)^{-1/2} = -H_E \qquad (26)$$

of dissipative pseudo-forces F_{∂}, which are determined by the cosmological λ-term of GR equations and are proportional to linear momentums P of these particles. The presence of these dissipative pseudo-forces in empty space is caused only by the evolutional decrease of the value of absolute velocity of light in the CFREU [16,17].

Therefore, Hamiltonian of free-moving test particle in CFREU (as well as in non-rigid FR of matter) does not conserve. And, consequently, inertial motion of this particle realizes in CFREU not along the geodesic lines of the STC of liquid and is hyperbolic even in case of hypothetical absence of gravitational field [18,43]. Analogously, because of evolutional decreasing of kinetic energy in CFREU the Earth moves in the space of this FR (in Newton-Weyl absolute space) not along the circular orbit, but along the logarithmic spiral. Unlike in CFREU and in non-rigid FR of naturally self-cooling body, in rigid FR of matter the strength of dissipative pseudo-forces:

$$\widetilde{\xi} = \breve{v}_l \breve{v}_{lh} / cr_c \approx \breve{v}_l \breve{v}_{lh} H_E / c^2 = 0 \qquad (27)$$

is equal to zero, as well as the limit velocity of matter $\breve{v}_{lh}$ on its event horizon. This is connected with the principal unobservability in matter FR of evolutional changes of values of the limit velocity of matter and of spatial parameters of matter elementary quasiparticles. And, therefore, Newtonian of inert free energy Keplerian of ordinary rest energy of matter conservation in rigid FR of matter takes place only because of gauge-invariance of eigenvalues of matter space-time characteristics [30-32]. Thus, physical vacuum is an active medium with energy dissipation in CFREU.

While in cybernetics and thermodynamics the most fundamental factor is the presence of negative feedbacks, which guarantee the stability of correspondingly complex systems and matter equilibrium states, in synergetics (the theory of dissipative systems) the most fundamental factor is the self-organization of spiral autowave structures in active mediums with energy dissipation. Spiral waves are the main type of elementary self-sustained structures in homogeneous excitable mediums [55]. The physical vacuum is exactly such medium. Therefore, matter elementary quasiparticles inevitably had to be self-organized in it exactly only as spiral waves. The following main regular properties, which are inherent for matter elementary quasiparticles and for spiral waves, also denote this:

1) wave-corpuscle nature of the elementary quasiparticles (they, like the nuclei of spiral waves, have spatial coordinates);
2) cooperative behavior of elementary quasiparticles, as well as of spiral waves;
3) presence of inertial motion (for elementary quasiparticles, as well as for spiral autowave structural elements);
4) presence of annihilation after collision (for elementary quasiparticles and antiquasiparticles, as well as for diverging and converging spiral waves);
5) presence of uncertainty in time and space of execution of quantum of action (it's impossible in principle to determine the beginning and the end of any spiral turn, which transfers the quantum of action, and, therefore, it's impossible to determine precisely the coordinates of world points, in which action executes);
6) possibility to interpret final local sinks of spiral waves as negative electric elementary charges, and to interpret their initial local sources as positive electric elementary charges;
7) the fact that electron has intrinsic angular momentum, which is not connected with its rotation (radial propagation of turns of spiral wave is analogous to the effect of rotation of rigid logarithmic spiral);
8) the fact that spin of elementary quasiparticles may take on positive and negative values (analogously to right- and left-hand spirals);
9) the fact that electron in atom transforms itself into orbital wave (analogously to transformation of spiral waves into simple vortex rings);
10) impossibility of existence of single quark, as well as of single twisted vortex ring;
11) presence of asymptotical freedom for quarks, as well as for twisted vortex rings, which are linked (interaction forces appear only in case of attempt to separate quarks or twisted vortex rings);
12) resemblance of topological limitations (restrictions), which greatly reduce the number of permissible

elementary quasiparticles and three-dimensional spiral structures;

13) very short lifetime of elementary quasiparticles, as well as of three-dimensional spiral structures, which can't be self-organized in structures of higher hierarchical level [55-59].

However, we need to find the answers on the following questions. Which of the known elementary quasiparticles are not fictive and, therefore, can be spiral autowaves? Space-time modulations of which parameters of physical vacuum can be three-dimensional spiral structures that correspond to elementary quasiparticles?

When we attribute to gravitational field the properties, such as has electromagnetic field, we can consider it as equal in rights with electromagnetic field and, therefore, – as something independent. But the well-known facts denote contrary. All four fundamental fields – strong, weak, electromagnetic and gravitational are based on electromagnetic properties of physical vacuum and matter and they are specific reflections of these properties on the various hierarchical levels of matter self-organization. Despite the presence of variety of resemblances of properties of fundamental fields, topological and other principal differences don't allow us to make total unification of all fundamental intercouplings (interactions) between matter elementary quasiparticles. For example, gravitational potential in matter FR is the function of velocity of propagation of electromagnetic waves in vacuum $v_c = (\mu_0 \varepsilon_0)^{-1/2}$, the value of which is uniquely determined by the values of permittivity ε_0 and magnetic permeability μ_0 of physical vacuum. Furthermore, the gravity reveals itself in macroworld only because of the presence of van-der-Waals forces of electromagnetic interactions between the molecules of hydrogen.

After all, only due to these forces molecules of hydrogen began to mutually self-contract in absolute space. In case of hypothetical absence of electromagnetic interaction, separately self-contracting molecules of matter would remain absolutely uniformly distributed in cosmic space and, therefore, gravitational macrofields that reflect physical macroinhomogeneity $(v_l \neq \mathbf{const}(x,y,z))$ of cosmic space would never be originated. This is the cause of absolutely different mechanism of action of gravitation. For electromagnetic interaction the change of linear momentum of elementary quasiparticle is realized merely because of the transfer of additional momentum from the free photon, adsorbed by it. Otherwise, the change of linear momentums of elementary particles in gravitational field is caused by principal nonconservation in physically inhomogeneous space of momentums of virtual quasiparticles and quasiparticles, which realize interaction between neighbouring stable quasiparticles as well as between these quasiparticles and the "cloud" of virtual quasiparticles [44]. Therefore, there is no necessity in the existence of specific quasiparticles (gravitons), which transfer momentum and energy during the process of matter motion in gravitational field.

Weak interaction of elementary quasiparticles also has electromagnetic nature. In fact, it is realized via exchange of virtual quasiparticles, which have not only mass, but also electric charge and in the process of their accelerated motion can generate ordinary electromagnetic waves. The possibility of unification of weak interaction with electromagnetic interaction into electroweak interaction also denotes this.

Strong couplings between quarks (between twisted vortex rings, according to 10) and 11)) are, apparently, absolutely topological couplings, such as couplings of chain links or couplings of nested structure elements. It wouldn't have been logical, if the nature hadn't used such simple mechanism of intercoupling of elementary quasiparticles. That's why there is no necessity in the existence of gluons, forced to "glue" quarks together.

Molecules of matter of real physical bodies execute heat oscillatory motions. Therefore, individual motion of molecules of hyperbolically accelerating body is not hyperbolic in fact. And, consequently, the values of strengths $-G_j(x,V) = (dP_A/dt)/H_A$ of gravitational field, which appears in FR of hyperbolically accelerating body, are only the average statistical values. In the places of dislocations of the molecules of moving body space-time modulation of the values of strength of gravity-inertial field, as well as of the values of frequency of interaction of matter elementary quasiparticles, which determines rate of course of proper quantum (standard) time of matter, takes place [44]. Therefore, intrinsic space of accelerating body is not only physically macroinhomogeneous, but also physically microinhomogeneous.

Because of high value of density of matter in atom nucleus average statistical relative value of the frequency of interactions *f* in the points of dislocations of protons and neutrons much lower than at the periphery of atom. As it follows from the solutions of GR equations, the decrease of the improper value of the velocity of light has the influence on the frequency of interaction of elementary quasiparticles, and this influence is partially compensated by the decreasing of the distance between the interacting quasiparticles in fundamental space. This compensation is like the compensation, which is realized by relativistic length shrinkage of moving body [18]. Therefore, physical microinhomogeneity of intrinsic space of matter, which is identical with Salam strong gravity, is always followed also by metrical microinhomogeneity or in another interpretation by the microcurvature (roughness) of this space [2,61]. Already in 1870 Clifford in his paper "On the spatial theory of matter" denotes the possibility of this: "I consider that small regions of space are analogous (by their nature) to the little hillocks on the surface, which is plain on average. So ordinary geometrical laws are inapplicable here" [58-60]. Being based on Clifford-Einstein spatial theory of matter, Wheeler elaborated the geometrodynamical theory of small-scale structure of space-time. This theory consider matter elementary quasiparticles as geometrodynamical excitons [64,65].

The presence of physical and metrical (scale) microinhomogeneities of space in the places of high matter concentration (in atoms nuclei) has profound physical meaning. This is the demonstration of the presence of negative feedback between the values of measuring physical parameter (dimension) and the values of the unit of this parameter (dimension) in CFREU. This feedback prevents catastrophic change of the parameter (dimension) in internal FR of matter and makes unreachable for it

both zero value and infinitely high value. Because of this, nuclei of atoms as well as astronomical bodies have individual pseudo-horizons of past and future, which assign correspondingly maximal and minimal physically realizable values of the luminosity radius in their intrinsic FRs.

In such physically and metrically microinhomogeneous space improper values of energy and linear momentum of elementary quasiparticles have to be determined with using of additional conform transformations or renormalizations, which would take into account these microinhomogeneities and their variation under the influence of destabilizing factors. Such renormalizations of physical parameters are being made during the process of finding of approximate solutions of the equations of nuclear and quantum physics via the method of perturbation theory. These true values of energy and linear momentum will be substantially smaller than their eigenvalues, which don't differ from their values in hypothetical physically and metrically homogeneous space. In spite of the small mutual difference between the eigenvalues of effective cross-sections of neutron and proton, and, consequently, between their values in rough internal space of the matter, in the Euclidean space of CFREU the value of effective cross-section of neutron is much smaller than the value of effective cross-section of proton. This is caused by the fact that the intrinsic space of neutron is more curved, and, consequently, by more considerable increase in density of flux of scattered quasiparticles in CFREU during their approaching to neutron (than for the case of approaching to proton). Therefore, during the process of neutron transformation into proton the work on neutron expansion in self-gravitational field is being executed in CFREU. In FRPW the execution of this work is aimed to increase the eigenvalue of energy $W = \tilde{m}c^3 / v_l$ via the decrease of local value of the limit velocity of matter v_l, which is substantially higher for proton than for neutron. The fact that we don't take into account the changes of local improper values of the velocity of light in the process of neutron β-decay is the cause of pretended energy deficit. This deficit is being determined as the difference of not real but effective energy values in initial and final states of elementary quasiparticles. Nonconservation of the linear and angular momentums in the process of β-decay is caused by the substantial physical microinhomogeneity of the space in atom nucleus. And, therefore, the existence of additional quasiparticle, which takes away part of energy and linear and angular momentums, is not required. Bohr hypothesis about energy nonconservation in subatomic physics have to be considered as applied for effective values of energies of elementary quasiparticles (for "projections" of real values of energies on conventional metrically and physically microhomogeneous space of macroscopic FR) [62,63].

Unlike eigenvalues, improper values of energies of different neutrons are unequal in CFREU even for the same atom. The dispersion of improper values of neutrons energy is caused by the substantial physical microinhomogeneity of the space inside the atom nucleus and by continuous oscillatory variation of gravitational energy of neutrons during the process of interaction of their quarks with the quarks of neighboring neutrons and protons, which are in actual as well as in virtual states. Analogously to the dispersion of kinetic energies of thermal oscillatory motion of molecules, it also obeys the certain statistical regularities. Therefore, like the spectra of frequencies and energies of the photons of thermal radiation, spectrum of the energies of electrons in the process of neutrons β-decay is continuous (unlike the case of the change of quantum-mechanical state of elementary quasiparticles, when the spectrum is discrete). Generally the dispersion of the energies of electrons during β-decay process is being explained by the dispersion of energies of antineutrinos, which are the thing in itself (like the black box in cybernetics) and as if they are radiated together with electrons. However, there is no intelligible explanation of the fact that antineutrinos itself have continuous spectra.

Victor F. Weisskopf has repeatedly pointed out that not only the photon, but also the neutrino are not particles [68,69]: "We do not count the light quantum among particles, since it is the quantum of the electromagnetic field and obeys Bose statistics. The neutrino is not included since it never appears as constituent of matter."

Of course, the using of individual average value of frequency of interaction of concrete elementary quasiparticle f in GR (or using of local value of the limit velocity of matter v_l, which is equivalent to f in principally uniform intrinsic space of elementary quasiparticle) is the same nonsense as the using of individual values of temperature and relativistic dilation of proper (standard) time of every separate matter molecule correspondingly in thermodynamics and relativistic mechanics. However, not taking into account such, as it seems, absurd nuances, in phenomenological thermodynamics, in statistical thermodynamics we, nevertheless, take into account the fact that molecules of matter, which is in equilibrium state, have the dispersion of the values of thermal energy (kinetic energy of oscillatory motion). Why then we have to neglect the dispersion of the values of gravitational energy of elementary quasiparticles in nuclear physics? Therefore, we should consider physical parameters of neutrino and antineutrino nevertheless only as corrections to mathematical dependences, which are acceptable only for conventionally smooth (without microcurvature) and physically microinhomogeneous spaces of phenomenological GR. The neglect of not only physical and metrical microinhomogeneities of fundamental space for elementary quasiparticles, but also of dispersions of gravitational energies of these quasiparticles, makes these corrections mathematically justified. And, therefore, fictive quasiparticles, which are the "carriers" of these corrections, can "take part" in nuclear reactions on a par with real elementary quasiparticles and, like them, can obey the laws of the symmetry of nuclear physics. Because of this, in nuclear reactions of transformations of elementary quasiparticles into new quasiparticles due to absorption or radiation of only neutrino (antineutrino) by them, in fact takes place only transition of these quasiparticles from one its metastable state into another its metastable or stable state. For example, transformation of negatively charged muon (STC topology of which is like the STC topology of hollow astronomical body) into electron is accompanied not only by pseudo-conversion of wave-front of its internal spiral wave, but also by the substantial decrease in physical microinhomogeneity of its internal space $(v_{ce} >> v_{c\mu})$[5].

Therefore, in spite of the equality of total energies (improper values of energies) of electron and muon, which had been transformed into this electron with conservation of total energy, effective values of energy and mass of electron in hypothetically microinhomogeneous and smooth (without microcurvature) space are approximately 207 times less than effective values of energy and mass of muon. And this takes place, despite the partial compensation of the effect, which is caused by more substantial physical microinhomogeneity of internal space, by the effect, which is caused by more substantial (than for electron) microcurvature of internal space of muon. Being based on hyperbole (excessive exaggeration) of this effect one can build geometrodynamical model of mass "without mass" (Wheeler geon [54,65]). In fact in this model one associates nonzero effective (eigen-) value of energy of elementary quasiparticle with zero value of its total energy (because of $\nu_c = 0$). The possibility of such hyperbole is the ponderable argument in favour of the conception of neutrino fictitiousness. It becomes apparent that in fact we register not neutrino but only the indirect consequences of nuclear reactions, in which as if they had to be originated. After all, phase changes of collective space-time state of matter and its gravitational field propagate with supraluminal velocity and can be registered in any point of space even without coming of hypothetical neutrinos to this point [44].

So among all well-known non-composite fundamental quasiparticles of matter only electron with positron, muons and quarks with antiquarks can be for sure non-fictive. And photon is the only one fundamental quasiparticle, existence of which is irrefutable. Being based on electromagnetic nature of all elementary quasiparticles and taking into account principal impossibility to register separate turns of spiral waves, we can assume the following: Electron with muon and quarks are space-time modulations of permittivity and magnetic permeability of unstructured physical vacuum in the form of spiral waves, which form correspondingly simple and twisted vortex rings in atoms [55]. In this connection, the topology of STC of muons, positively charged quarks and negatively charged antiquarks is like the topology of STC of hollow astronomical bodies. At such topology of quarks the twistedness of vortex rings is obligatory only for internal microsubspace of enveloping quark (antiquark) and for external microsubspace of antiquark (quark), which is confined in the internal microsubspace of any other enveloping quark (antiquark). Such nested structure, which consists of enveloping and confined quarks, corresponds to π-mesons. Due to untwistedness of vortex ring in external subspace of enveloping quark, π-meson can be transformed into muon. This transformation is the result of annihilation of twisted vortex rings of enveloping quark and antiquark, confined into it, which takes place in the internal microsubspace of this quark. Vortex lines of spiral waves of quarks, which form resonances and some other metastable quasiparticles, can not only form circle, but also can be tied in a knot [55,58]. It is possible that closure of conventional vortex lines into rings, as well as closure of terrestrial orbit, takes place only in FRPW (matter FR) and is absent in CFREU [11].

Electromagnetic waves, which imbue these vortex rings and knots, are the waves of modulating oscillations of electric and magnetic strengths. These oscillations are superimposed on more high-frequency quasiperiodical carrier oscillations of these strengths. Carrier oscillations (as well as oscillations of permittivity and magnetic permeability) are realizing on de Broglie frequency of totality of all matter objects, on which collectivized turns of spiral waves surge at the velocity of propagation of front of matter intrinsic time in CFREU. Therefore, every of these turns corresponds to simultaneous (coincident) events, and thus, to certain collective space-time (microphase) state of whole matter, on which it executes quantum of action [44]. This is in a good agreement in Einstein-Podolki-Rosen paradox with momentary mutual coordination of changes of quantum-mechanical characteristics of previously correlated photons or elementary quasiparticles after mutual self-distancing of them on long distances [70,71]. The presence of metrical (which causes curvature of matter intrinsic space) and physical (identifiable with gravitational field) macroinhomogeneities of CFREU space may be caused by increasing (from periphery to the center) of spatial density of collectivized turns of spiral waves. This increasing of density of turns of spiral waves is inevitable because of shrinkage of distances between peaks of solitons, which form these turns, as they approach to the center. Also this increasing causes origination of metrical and physical microinhomogeneities of space in the places of dislocation of atom nuclei[6].

Microcurvature and physical microinhomogeneity of intrinsic spaces of protons and neutrons also take place because of increasing (from periphery to the center) of density of their individual spiral turns. But these localized inhomogeneities can't be determined via solving the equations of gravitational field. In fact, GR, as well as mechanics and thermodynamics, operates only with average statistical parameters and as well as SR (Heisenberg paid attention on inadequacy of description of space-time relations in microworld by SR) provides only absolutely solid and locally uniform fullness of space by matter [72]. Moreover, microcurvature and physical microinhomogeneity of space strongly vary in the process of interaction of elementary quasiparticles. Therefore, equations of quantum physics, which implicitly allow for (or must allow for) microcurvature and physical microinhomogeneity of space, have to be solved together with equations of renormalization group. And this means that metrical correlations in microworld are nontrivial (Zelmanov postulates that they are absent at all; Menger proposes to bring in statistical notion of distance between the points) and don't allow us to formulate conservation laws in ordinary form. So, in matter rigid FR spatial distributions of the values of microcurvature and physical microinhomogeneity of its space are not stable in time (unlike the distributions of macrocurvature and physical macroinhomogeneity) [52,73,74]. And this leads to nonconservation of momentary values of energy of photons, as well as of elementary quasiparticles. And, therefore, only average values (mathematical expectations) of energy of elementary quasiparticles can conserve in microworld [43]. Measure of inaccuracy in determination of this average value of energy: $\Delta E_{\min} = \hbar / \Delta t$ will be smaller, if time interval of its measuring is longer. That's why Heisenberg uncertainty relations in fact formulate conservation laws in microworld (in subatomic physics). Statistical nature of the conservation laws is conditioned by two following main factors: by fulfillment of these laws in intrinsic physical space of matter, which is inseparable from matter and thus from natural clock of this matter, (not in intrinsic metrical

space, in which matter is being deformed, and thus its natural clock are not motionless); and by stochasticity of microstructure of physical space, which have to be inseparable from every elementary quasiparticle of matter in intrinsic collective FR of the whole matter [40,43,44]. The possibility of bringing in the notion of indeterminate system of coordinates (stochastic FR) considered Shirokov [75].

Based on the algebraic theory of metric relations (the theory of physical structures by Kulakov, Mikhailichenko, and others), Vladimirov proposed a relational theory of space-time and interactions that allows for a "pre-geometric" description of non-trivial metric relations in the microworld [76,77]. This theory is based on physical concepts of the macroscopic nature of classical space-time and the existence of direct interparticle interaction, following from the alternative to field theory the Fokker-Feynman concept of long-range action [77–83].

Vortex lines of converging spiral waves, which correspond, according to 6), to negatively charged quasiparticles, are stable only in the space or microsubspaces, in which $\partial r / \partial R > 0$. Vortex lines of diverging spiral waves, which correspond to positively charged quasiparticles, are stable only in the space or microsubspaces, in which $\partial r / \partial R < 0$. Only in these spaces or microsubspaces their phase trajectories are winding up on limit cycles. Therefore, positively charged quarks of absolutely stable quasiparticles (protons and neutrons) are self-isolated from external space by metrically singular surface and turns of their spiral waves are draining to pseudo-horizon of future of microsubspace, limited by this singular surface. Because of this Schwarzschild-like radius of influence of strong gravitation is of the same order of magnitude with dimensions of protons and neutrons [2]. This singular surface is the sink of turns of spiral waves in external space and also it is their source in microsubspace, limited by it[7].

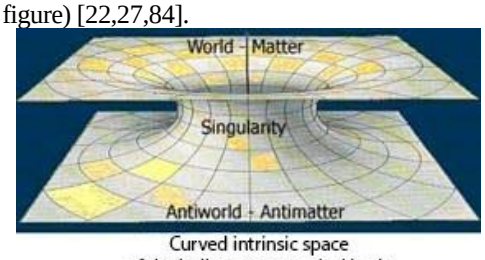
In this microsubspace singular surface is considered as convex surface, which contains whole Universe. That's why in the FR of positively charged quark of proton, which is confined in singular surface, the Universe can be considered as negatively charged baryon. And this is one of the reasons of utopian considering of elementary quasiparticles as microuniverses [2].

In general case two different topologies are possible. If positively charged quark have hollow topological form and is quasiconcentric to singular surface, in which it is confined, in absolute space, then in its FR the Universe will be confined in it. And when this quasiconcentricity is absent the planetary model will be realized. As if positively charged quark revolves around the negatively charged Universe. Transition from one topology to another corresponds to the change of metastable state of quark (to the change of the values of its quantum numbers) and not obligatory have to be connected with absorption or radiation of any specific quasiparticles or fictive quasiparticles by it. Negatively charged d-quark of proton, confined in this singular surface, in addition may be confined in the singular surface of one of two positively charged u-quarks (as in multiple nested structure). Therefore, these two u-quarks will be in nonidentical quantum states (will have nonidentical "colour"). Because of this, d-quark itself can be only s-quark, which is additionally confined in singular surface, which hides ("screens") its strangeness, of any other quark[8].

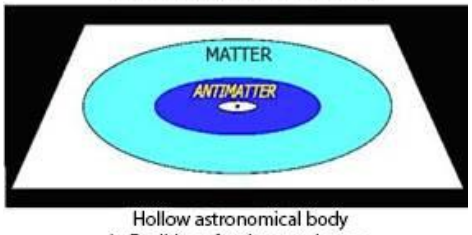
These singular surfaces can be spherical or ellipsoidal (when spiral wave tends to degeneration into concentric waves of pacemaker in FR, in which elementary quasiparticle, formed by this spiral wave, is motionless) or toric, or maybe – they can be closed surfaces of more complex form in the case of formation of vortex knots [55]. Confinement of several quarks by the same singular surface makes requirement of twistedness of vortex rings of spiral waves of these quarks not strongly obligatory (surplus). That's why we can't exclude the possibility of self-organization of all or only of some types of quarks in the form of simple vortex rings.

The description of antimatter micro-objects, which are contained in internal half-space of hollow body, is analogous. Physical notions, shown here, amplify well-known theories of elementary quasiparticles very well, but only in the case of inevitable remaking sense of these theories (and possibly – with modernization of some of them).

According to all this, elementary quasiparticles and matter, which consists of them, are stable only in external empty space and in external half-layer of the hollow body. On the contrary, antiquasiparticles and antimatter, which consists of them, are stable only in internal empty space and in internal half-layer of the hollow body (see figure) [22,27,84].



Curved intrinsic space
of the hollow astronomical body



Hollow astronomical body
in Euclidean fundamental space

And, therefore, median singular surface of hollow body is a natural barrier between matter and antimatter, which preserve them from catastrophic annihilation. Sporadic leakage of matter and antimatter through this barrier is possible in principle (even without bringing in quantum-mechanical notions about motion), because of incompletely mutually coordinating (without this leakage) self-cooling of external and internal parts of not absolutely cold hollow body. This self-cooling disturbs the common equilibrium and thus leads to radial migration of singular surface relatively to matter and antimatter. Due to matter and antimatter annihilation, which is the cause of this leakage, unlimited in time maintaining of radiant emittance of hollow body with as cold as desired boundary surfaces is possible. In non-rigid and quasirigid intrinsic FRs of self-cooling hollow bodies the value of luminosity radius of median

singular surface is continuously decreasing $(r_0 \neq \mathbf{const}(t))$. All events that coincide in matter intrinsic FR can be brought into accord with every concrete value of this radius (as well as with the value of radius of observer horizon) [40,44]. Because of gradual displacement of median singular surface of self-cooling hollow body in its intrinsic space, the value of limit velocity of matter on this surface (as well as, according to (27), on the singular surfaces of pseudo-horizons of past and future) can be as small as desired but nonzero in rigid and quasirigid FRs [40]. This guarantees the possibility of unimpeded one-way overcoming of barrier between matter and antimatter, namely – the possibility of continuous penetration of antimatter to matter (to the external part of hollow body). Thus, continuous course of the process of gradual annihilation of matter and antimatter in hot hollow bodies is guaranteed. And, therefore, annihilation of matter and antimatter is the main source of energy of hollow bodies.

It should be noted, that before the moment of discontinuity of mainly hydrogenous continuum of Universe into single gas aggregates there was no antimatter in Universe. Initial self-organization of antimatter could take place only because of the origination of ultrahigh eigenvalues of matter density, pressure and temperature, and, consequently, because of the origination of critical density of energy of thermal electromagnetic bremsstrahlung and origination of space region with unstable sphero-cylindrical metrics in the center of gigantic gas aggregates. Therefore, formation of initial ("seed") antimatter, which have caused the transformation of unstable uniform sphero-cylindric metrics at first into topologically inhomogeneous metrics and then into extraordinary metrics of its intrinsic space, may took place because of the birth of pairs of quasiparticles and antiquasiparticles, which have correspondingly ordinary and extraordinary metrics of intrinsic microsubspaces and, therefore, don't have time for mutual annihilation, in photon gas. Unification of microsubspaces that have extraordinary metrics into space-time continuum have led to localization of singular state of matter only on spherical singular surface, which began to "inflate" (increase its radius) in absolute space. Transformation of originated, as well as of already existed, elementary quasiparticles into antiquasiparticles realized as singular surface inflated due to reversal of the wave front of their spiral waves.

Separate gas aggregates have catastrophically self-contracted in intrinsic space, because of origination and rash increase of spherically symmetrical physical macroinhomogeneity of space, which led to nonconservation of linear momentum in space. Self-contraction of gas aggregates have been realized because of the growing of both momentum increment of inward (centripetal) and momentum decrement of outward (centrifugal) virtual photons in the process of Van der Waals electromagnetic interaction between gas molecules. Physical macroinhomogeneity of space (originated only in the process of this and identifiable with gravitational field), of course, have led to polarization of physical microinhomogeneities of space, which are formed by atoms. Therefore, virtual (-mesons and photons, which realized intra-atomic interactions between protons and correspondingly neutrons and electrons, also took part in pushing of atoms to the center of gas aggregate [44]. They take part now in production of body free fall and in setting body in motion by any non-gravitational forces. And also they are indirectly accounted for atoms inertia because of finiteness of frequency of these interactions[9].

All this has caused the origination of gigantic gas aggregates with hollow topological form in the Universe. Quasars have been originated from the nuclei of the most stable gas aggregates. Because of the large accidental, as well as autowave, fluctuations of thermodynamical characteristics of matter and antimatter inside quasars, rather substantial radial migration of their median singular surface took place. This, together with unequality to zero of the value of limit velocity of matter on this singular surface, was the cause of intensive course of the process of matter and antimatter annihilation, and, therefore, the cause of ultrahigh luminosity of quasars. The process of formation of supernovas from hollow stars is also accompanied by annihilation of matter and antimatter. Short-term ultrahigh luminosity of supernovas is caused exactly by this.

Absolute matter stability is caused by the presence of the phenomenon of scattering of distant objects from observer (Universe expansion). On the contrary, absolute antimatter stability is caused by the presence of the phenomenon of crowding of distant objects on the observer. Therefore, Universe expansion in principle never can turn into its contraction. This expansion is an infinitely long evolutional process. This process is caused, the same as continuous existence of matter in Universe, by continuous gauge-evolutional change of physical vacuum properties (physical vacuum ageing).

Footnotes:

1. Supplemented and completed version of the article from the collection of articles "Gauge-Evolutional Interpretation of Special and General Relativities", Vinnitsa, O. Vlasuk, 2004.
2. Evolutionary decreasing (pseudo-dissipation) of the quanta of radiation energy and kinetic energy of micro- and macro-objects of matter in CFREU (in matter FR it's unobservable in principle) is connected neither with the transfer of this energy to any "dark non-baryonic matter" nor with its taking away by any quasiparticles. This decreasing is caused only by evolutionary change of value of the limit velocity of matter in CFREU.
3. It is not excepted that scale of cosmological time, which is being used now, may be metrically homogeneous (uniform for self-cooling stellar matter) but only for noninitial phase state of matter, in which translucent substance started to cool down because of the origination of free (nonvirtual) photons. Then the singularity of Friedmann-like solution, which corresponds in this case to matter only after the origination of cosmic background, will be located beyond the region of existence (physical realization) of this solution in coordinate time of FR that corresponds to it. The duration of cosmological time of self-inflation of the Universe before the start of self-cooling of its matter can't be finite, according to (16), and for as small as desired

finite values of uniformly distributed in early Universe protoparticles of matter [48].

4. Due to gauge invariance of people's world [10,11,15,20-22] to scaling transformations of matter in fundamental (absolute) space (this invariance is based on the principal metrical homogeneity of intrinsic space of matter), geometrical properties of space are generally examined in GR with the use of such characteristics as curvature of space [43]. However, mathematical apparatus of Riemannian geometry allows us in principle to describe geometrical properties of Euclidean spaces, which are metrically (by scale) inhomogeneous for matter according to Weyl hypothesis [11-13,49]. This takes place because of possibility of one-to-one mapping (for the chosen coefficient of scaling transformation in one of the space points) of Riemannian metrically homogeneous space onto Euclidean metrically inhomogeneous space. Poincare denotes the possibility of interpretation of curvature of matter intrinsic space as the consequence of nonuniform deformation of this matter in Euclidean space under the influence of physical fields [50-52]. The possibility to determine space-time state of matter in scale-inhomogeneous pseudo-Euclidean space is the important factor for quantum mechanics, in equations of which curvature of space is not taken into account.
5. There is no wave reflection and, therefore, no change of the direction of its propagation during the process of pseudo-conversation of wave-front. Only change of the wave character takes place – substitution, in this case, of wave divergence by wave convergence. But it takes place only in internal intrinsic microsubspace of muon, because in absolute space spiral wave, which converged initially, will continue to converge.
6. In compliance with this, we should consider spiral waves of space-time modulation of permittivity and magnetic permeability of physical vacuum as primary phenomenon, while formed by them elementary particles (individual turns of spiral waves) and also electromagnetic and gravitational fields (collectivized, as well as individual, turns of spiral waves) – only as secondary phenomenon Therefore, conventional division of matter onto substance and field is not strongly correct. Substance "coincides" with physical vacuum, as well as with gravitational field, but not via superposition of it on them. Elementary particles are just excited state of physical vacuum and solitary zones of electromagnetic and gravitational fields.
7. In the absolute space the gradient of electric strength on the singular surface of the gullet of intermediate sink tends not to infinity (as it takes place in singular points of final sinks), but to its finite value, and only after passing through the gullet begins to increase more sharply. However, in intrinsic space of the particle the gradient of electric strength reaches its maximal value on the singular surface of the gullet and then begins to decrease. Therefore, spiral wave doesn't break (doesn't disappear) on this singular surface and only changes its character in intrinsic space of the particle – becomes divergent. For the same reason, the charge of intermediate sink in external space is not negative but positive.
8. However, it is not excepted that not only positively charged, but also negatively charged quarks have the topology of hollow body. Then, on the contrary, two positively charged u-quarks, which have different signs of spin, can be confined in negatively charged d-quark of proton. And, therefore, singular surface, considered here, belongs exactly to this d-quark. d-quark itself can be just s-quark, which is in comfort conditions and so doesn't have strangeness.
9. Inertia phenomenon is the cause of the possibility of transfer of energy and linear momentum only by small portions (quanta), and also of finiteness of the value of velocity of propagation of particles and quasiparticles, which transfer these quanta of energy and linear momentum. And it can't be connected with Mach principle [60].

Conflicts of Interest

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