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Is the Evolution of Mankind and the Universe Solely a Physical Selfrunner?

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1. Introductory considerations

For many people of our present, thinking mankind it appears already as a deep intellectual sin to aim at a physics-based natural, purely scientific explanation of what happens all round in the huge universe: it is in fact seen as the so-called "cosmologic sin"! This is because such an arrogant attempt is directly ranked by most people confronted with it as a clear disdivination of the holy creation of the total world, identifyable with a revocation of any independence and internal beauty of the cosmic creation. It is, as if already the simple attempt to look for a physical explanation of the cosmic evolution would convert the world into a manmade universe and would represent a full dechantment of its gloriosity - rather degrading the latter to a trivial mechanical clockwork. But is it not just too marvelous, seen in a little bit alternative view, that the human attempt of the rational interpretation of the manifest cosmic world just represents a wonderful indication, that this universe - as a completely transcendental being for the human consciousness - talks to this human brain and thereby even installs in fact a tight, valid and mutually supported interaction?

Mysteriously it rather is as if the human being thereby with sole efforts of his intellect understands the universe, - and the universe as such gets translated into a mankind-digested universe without thereby becoming his own purely immanent good? And the latter is evident, since our intellectual power always needs the control by the given transcendental cosmic input indications. Never a physical explanation of the transcendental world originates by its immanence in our brain, because permanently our rational conclusions need the support by the transcendental reality of the universe in order not to run into the risk of a complete misunderstanding. Under the perspectives of the present-day astrophysicists the universe as a whole and its intrinsic processes driving the cosmic evolution simply appears as outcome of a pure mechanics of unavoidable, automatically upcoming physical constellations. According to this view the huge number of cosmic events should rather enforce a clearcut determination for the future than to characterize a unique evolutionary process, about similar to a biologic evolution. Everything that can happen appears as fully preprogrammed by cosmic conditions and physical laws with no degrees of evolutionary freedom. Future events appear as a "must" rather than a"could"!

This is why one should ask really deeply moved, whether the pure government of natural laws would at all permit something qualitatively new and unpredictable to come up in the real world of this universe. Or is the cosmic event history simply nothing else but a consecutional downworking of a preexisting causal constellation context? Perhaps an eyeguide here could be the basic recognition of physicists: Occurences and physical events - according to natural laws are guided by the second main-law of thermodynamics, namely the law that the entropy of the physical system has to be increased by these occurences, or expressed in a less physical diction, the disorder of the physical system has to be increased by occurence of just that what happens in fact. Occurences obeying this main law should therefore unavoidably consume the prevailing information established in the primary constellation of the state of the universe in favour of installing more and more passive disorder, unable to give new impacts for upcoming events. And is it therefore not simply so, that the cosmic evolution represents nothing else but a monotonic way towards the entropical death of the system "cosmos", - a suffocation of the universe into its complete chaos -, i. e. a complete cosmic garbidge - and with that fate determined to a hope-lessly monotonic way from an information-rich beginning towards a maximally information-less garbidge universe at the end with no potential for new events. In conclusion: Actually only that happens what needs to happen for the sake of a gradual or complete information destruction!

At this instant of thinking on the destiny of the cosmic nature automatically the question may be raised why at all should the universe be subject to the brain-made, scientific maximes of the human consciousness? Does it mean the universe is a creation of the human brain? Definitely not! Since the human brain has not autopoetically made this universe, like for instance the poet creates his poem in the best possible correspondence to his intuitions, rather this brain, however, creates it with the help of the rational light that maybe God offers to this human brain at the human ambition to comprehend the universe. In this respect: - God, the human brain,

and the universe - have to be seen as a common unique entity! That a selfconsistent, selfmaintaining cosmos can not be made by the human brain itself in its own rights, becomes very clear in the modern cosmologic visions which permanently prove themselves to be insufficient and improveworthy. This becomes clear as soon as one recognizes, how bad, perturbation-sensitive and fragile this human world concept of the universe in fact is, and how much this concept permanently needs inherent ad-hoc-assistances and -corrections in order not to deliver terrible mispredictions.

It may be evident that following purely human brain insights one can not hope to create a satisfying, selfconsistent and self-maintaining universe. This often becomes more than evident in the insufficiencies of cosmologic views of our present times. This present-day cosmology namely delivers a badly designed universe which permanently needs revisions, corrections, and additional ad-hoc assumptions, and can not persist as it is designed [1]. We can only all be very happy that we need not live in a universe purely concepted by the human brain. For example: If in fact, as according to standard views of the present-day cosmologists, the universe originates in the Big-Bang, then it is evidently not understandable, how already in this up to the present days physically not understandable Big-Bang inferno the most precise decisions could already have been made for the origin of mankind including ourselves in the later phases of the universe – and nota bene: a mankind who wants to believe that it understands the universe! If in contrast to this view the universe rather represents a selfmaintaining, thermodynamic equilibrium state as for instance in case of an attractor system, organized in well-tuned action circuits each of which acts back to the rest of the others of the cosmic system, then it may be much better understandable that in this infinitely recoupled system also mankind, its life and thinking, can be expected to come up as an evolutionary event product [2].

This in fact could also be a good reason not to investigate further, whether the cosmic evolution has the anthropic task to create mankind as one of its intrinsic aims. Rather it should more positivistically be asked how it could be arranged that the universe is a transcendental-estethic object of the human brain, or to be asked in a different form - how the universe could at all become a conversation partner of the human brain. One important answer to this difficult question had in principle already be given by Nikolaus Kusanus (1440), the Dominican monk and later bishop of Brissona, in his book "De docta ignorantia" [3]. There Nikolaus emphasizes that the cosmos is the mirror view of our human brain - as on the other side - the human brain is the mirror view of the cosmos. We do understand the universe as the mirror image of our brain, and it is God who confronts us with this image. This for many of us may sound a little bit too religious and theistic, but, as we shall show, it nevertheless has a deep, non-religious truth in it. As we shall show in what comes further down here, the present-day cosmology delivers a badly designed universe with inherent prediction concepts that need a permanent improvement and ad-hoc update, if the inherent predictions are not to fail in finding the cosmic truth. Would the universe be constructed as cosmologists presently see it, then there would be no place for human life in it, because the isolated human brain never would have thought of a mankind having its native home in this universe. Whether and if at all in the frame of such an imperfectly designed world the beginning and the end of this world is clearly predicted, thus does not present a scientific certainty.

Cosmology rather tries to represent something like a scientific narrative of the world‘s creation - something which is offered to the non-scientist to make him understand how the world can be seen with the force of the logics of our human brain. Perhaps God first has to give to our brain just this logic light to see the world. The world which we see in the light of this ratio thus is nothing less than the worldlike light of God. The cosmologically understood world thus does not replace God and makes him unnecessary, it to the contrast especially delivers just the worldlike recognition of God. What at all should the universe serve for without the spirit of God as its creator and without mankind as its creation? Cosmology in this sense is perhaps a scientific parable of the creation, perhaps like a narrative which is offered to the outsiders - a world seen in the light of our logic brainpower. It perhaps remains to emphasize that God gives this logic the light to see the world, and in this sense the world for us, one could say so, is nothing less than the earthly appearance of God.

2. Can the Cosmologic View Ontologically Support this Universe?

Modern cosmology starts from the theoreme that the universe has a clearly determined beginning in our general space-time frame, and that this beginning can still today be identified in the present features of the existing universe. In addition to that it is assumed on the basis of the "cosmological principal" that no spacepoint in this universe is prefered in any respect, that to the contrast the universe with respect to all its energy depositions and physical conditions, at least seen on larger scales, is a completely homogeneous, monolithic building [6,7]. No human being ever born and living in this universe will thus have an individual advantage by its birthplace. This "equal-chance-principal" will, however, only be valid what concerns cosmic space coordinates, concerning cosmic time coordinates it is different: of course in the infernal epochs near the Big-Bang event no human being could have been born or have survived. Thus the Big-Bang period, if it ever at all occured, was free of biologic life. This conclusion evidently only comes up in connection with the imputed beginning of the universe in form of the Big-Bang. As already mentioned before under the assumption of an attractor-like, chaotic universe with infinitely many recoupled action circuits mankind could have been a permanently essential component of such a universe with no priority neither concerning cosmic time nor cosmic space coordinates [1]. This also would imply that no cosmic space-time point would be a favour for cosmic life. However then the question concerning the beginning of the cosmic world would be completely irrelevant, since, as one knows, all nonlinear-chaotic physical systems can not be traced back to their beginnings, they instead lose any hint to their origins. To scientically inquire about the beginnings of such chaotic systems would in fact be an "unscientific" endeavour. Wherever an observer in this latter universe sees the cosmic events happening,

he does not get any indication from them for the beginning of such events.

This is comparable for example to the story of the weather on Earth. Hereby also no one is inquiring how the initial state of the weather on Earth was- like in the form: How did the weather on Earth once start? Rather in the present-day meteorology one is asking how based on the knowledge of the present state of the weather over the globe the upcoming phases of the global weather conditions in the frame of short-time predictions in the near future can then be predicted. The present weather is destined to create its changes in the near future; one does not meet the right science conditions when asking for the end or the begin of these processes. For the cosmology this means one has to study carefully the present status of the cosmic events and then in the frame of physical process knowledge dare to make a prediction for the upcoming status of the cosmic state. That, however, means: We have to study the universe on the basis of its present status, rather than looking for an initial state of that status. This would in fact then be a completely new approach for cosmology: instead of binding the present universe to its preexisting initial states, e.g. like a Big-Bang or something similar, namely to understand the world on the basis of its timeless, enduring state. This means we should understand the universe on the basis of its present state, rather than on the basis of its imputed initial states like a Big-Bang or a Pre-Big-Bang.

3. The Present Standard Cosmology

The present standard cosmology starts from the assumption of a complete homogeneity of the cosmic energy distribution in the frame of the so-called "cosmological principle" [6,7]. This homogeneity and, connected with it, the imputed curvature isotropy then allow with the help of the Robertson-Walker metric which then adequately fits the problem to convert Einstein‘s general relativistic tensorial field equations to only two non-trivial differential equations which describe by the functions $\dot{R}$ and $\ddot{R}$ the velocity and the acceleration of the scale R of the universe as function of cosmic time t [8, 9]. In these Friedman-Lemaître equations it also has been assumed, that the massive cosmic particles in the sense of Einstein [10] lead to a homogeneous, but world-time and scale-variable mass density $\rho = \rho(R)$ which due to particle number conservation and particle mass conservation is reversely proportional to the world volume, i.e. given by the following expression: $\varrho = \varrho_0(R_0)[R_0/R]+3$.

In addition to that, modern cosmology attempts consider a constant vacuum energy density which had been proposed by Einstein in the year (1917), and following him is denoted by Λ [10]. According to this term each cosmic volume gets ascribed an energy which is proportional to the size of that volume - so as if it required a specific energy in order to at all create such a cosmic volume. Hereby the physical nature of that energy has not been understood, Einstein [10] only created this term for the sake of creating a stable, static universe which he thought he had to look for at his times. Einstein‘s Λ-term thus is not connected with real particles, but represents a "volume-specific"- energy term, the physical nature of which has not been understood up to the present days, but its mathematical nature becomes easily evident in the Friedman-Lemaître equations [8,9]: It namely has an accelerative nature, in contrast to the decelerative nature of all the other particle-specific terms, and thus is the only term supporting the expansion of the universe. Concerning the cosmologic action of this term this leads to a game of the competing parameters: as consequence of the relative strengths of the matter density and the vacuum energy density in relation to the so-called critical density $\rho_c = 3H_0^2/8\pi G$ (H_0 = Hubble constant; G = gravitational constant) one gets different forms for the cosmic scale $R(t)$ as function of the cosmic time t (illustrated in Figure 1) which evidently would predict different forms of the past and future of the universe given for different values of the critical density ρ_c.

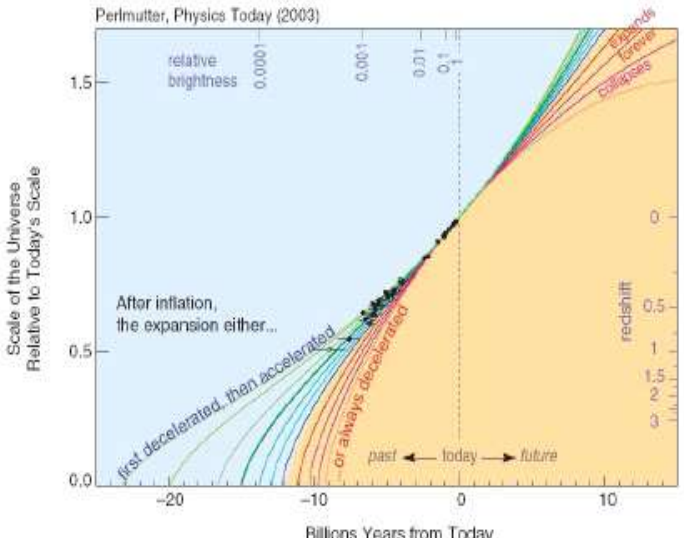

Figure 1: Alternative solutions of the Friedman-Lemaître equations taken from S. Perlmutter, Physics Today, April, 2003, 53-60.

One can now try to select out of the multitude of solutions shown above figure those which in view of the astronomical facts seem to be the best fitting ones. The hereby relevant astronomical facts for that purpose unfortunately are not simply laying in the hand of the astronomers and hence do not permit to make an easy decision. Rather they have to be found along complicated strategies in a theory-immanent manner from astronomical observations. For instance the observed minimal temperatures of the cosmic microwave background radiation can along an extended chain of cosmology-loaded intersteps be made matching the birth regions of present galaxies and galaxy clusters [11]. Also the distance of the most distant SN1a- supernovae can be found by the best-fitting cosmology models with values such that the observed apparent radiation magnitudes and the expected absolute luminosities of these cosmic standard radiators fit nicely together in the frame of the cosmic standard modellings [12]. As it turns out these days a best-fitting cosmological model can be identified thereby which, however, may astonish all independent researchers very much what concerns the required energy ratios of this best fitting universe. It namely turns out that 72 % of the energy that constitutes our universe is "dark energy" or vacuum energy. The second most important part is due to "dark matter", a form of matter that more recently is simply called for in order to explain the rotation patterns of galaxies. This kind of dark matter does not intereact with electromagnetic radiation and therefore is invisible. It thus cannot be detected directly,but only indirectly through its contributions to the cosmic gravity fields [9]. The central message of this new cosmology thus is: The most essential ingredience of this universe seems to be the non-understood vacuum energy! As a kind of historical irony in the years 1719 and later the Philosopher G.W. Leibnitz had formulated the ontologically most important question concerning the true substance of the universe: "Why at all is there actually something in the universe, and not just nothing? (Pourquoi est ce qu ´il y a plutot quelque chose - que rien?)". Today in present times the question rather seems just to be the opposite: "Why is there so much nothing, instead of something in world ?". Nevertheless under these unexpected cosmic energy proportions the famous Hubble constant $H(x) = \dot{R}(x)/R(x)$ and the expansion velocity of the universe $\dot{R} = \dot{R}(x)$ evaluate in forms like it is shown in Figure 2:

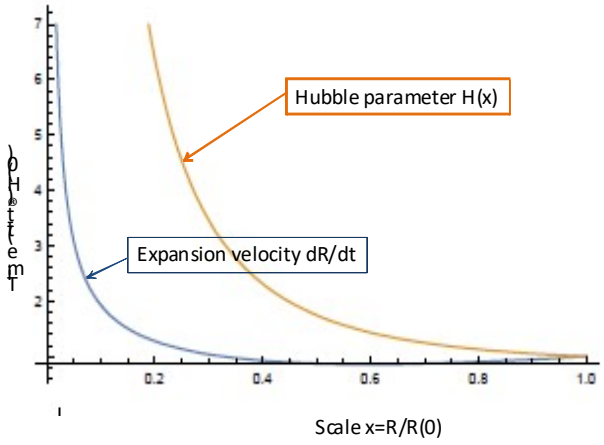

Figure 2: Shown is the Hubble Parameter $H = H(x) = \dot{R}(x)/R(x)$ (Yellow Curve) and the Expansion velocity $\dot{R}(x) = d_r(x)/dt$ (Blue Curve) as Function the Normalized Space Scale $x = R/R_0$ calculated on the basis of best-fitting values for $\Omega B, \Omega D, \Omega v$ *and* $\Omega \Lambda$, found by Perlmutter et al. (1999) [10]. Figure is taken from Fahr (2022): Phys. & Astron. Internat. Journal, 2022, 6(4), 135-140)

4. The Unholy Malediction Connected with the Vacuum Energy Density

The question what in fact means the concept of "empty space" or its synonym "vacuum" has astonishingly enough not sufficiently been answered up to the present days, but nevertheless the answer to this question seems to be of first priority and of fundamental importance for the understanding of the universe. Therefore this question, since the epochs of the Greek natural philosophy up to the present times of the modern quantumfield theory, has always been posed in new forms and has always been answered in different aspects. Hereby the answers to this fundamental question given over the past centuries have been analysed by different authors, but should not be repeated here. Rather some of the most fundamental aspects of this question, however, may serve the understanding of the coming article [11-13, 2].

Especially challenging hereby is the idea that empty space, despite its conceptual emptiness, nevertheless is expected to be energy-loaded, in first order simply because of its genuine property to allow as physical space disposable locations with different energy depositions. This is a little bit strange aspect and we shall investigate it deeper in the text below. In a short definition we want to classify the empty space as a spacetime without "topified" or localized energy representatives, for example without mass singularities like point masses as baryons, leptons, darkions or photons. Nevertheless it had to be discussed, whether such empty spaces could be energy-loaded. Such a form of energy would have to be described as a pure space-energy, somehow connected with the sheer size of the space or perhaps with its space-geometry as it is aspected by the general relativity theory as an expression of the energetisation of the ambient cosmic space. Naturally in such an "anonymous", empty space no space point is permitted to have any

priority with respect to the other space points in the neighborhood. If curvature properties are to play a role hereby, then only if no local priorities are associated with them. Such properties thus only may be connected with general geometrical properties of the space like general global properties, e.g. as the general space curvature characterized by the curvature parameter *k.* In this sense Fahr has shown that the conservation of the vacuum energy of the dynamical cosmic spacetime can be formulated as conservation of the proper energy of the comoving cosmic proper volume [4]. The invariance of this proper energy of course can only be expected, if this quantity does not perform work at the dynamics of the cosmic space-time - in the frame of the Robertson-Walker cosmology this means - by influencing the cosmic scale function $R = R(t)$, since the size of the cosmic space is directly associated with this quantity.

In this sense it has been shown that the conservation of vacuum energy of the dynamical cosmic space-time can be formulated as conservation of the proper-energy of the proper volume that co-moves with space-time [4]. Of course this invariance can only physically be expected, if this quantity does not perform itself simultaneously work at the cosmic spacetime, - cosmologically expressed - in the frame of the Robertson-Walker geometry by influencing the evolution of the scale function $R(t)$ as function of the cosmic time t [9]. This function is directly associated with the metrical size of cosmic space. If to the contrary such a physical work is performed, and the vacuum energy influences the space-time dynamics, then automatically thermodynamic boundary conditions have to be satisfied, as especially the following one between the vacuum energy density ϵ_{vac} and the vacuum pressure p_{vac}:

$$\frac{d}{dR}(\epsilon_{vac}R^3) = -p_{vac}\frac{d}{dR}R^3$$

The above thermodynamic requirement can mathematically only be satisfied, if the following relation between ϵ_{vac} *and* p_{vac} *is* fulfilled:

$$p_{vac} = -\frac{3-\xi}{3}\epsilon_{vac}$$

where ξ as the polytropic index of the vacuum is a pure number which evidently for $\xi = 3$ characterizes the case of a pressure-less vacuum with $p_{vac} = 0$. In fact one may for sure not know yet very much about the vacuum energy, but clearly defined relations between pressure p_{vac} and energy density ϵ_{vac} of the cosmic vacuum one at least does know for sure. And connected with it one knows still a lot more!

This, namely, means that the heavily "theory-loaded" consense model shown in Figure 1 therefore is questioned by several serious theoretical-physical problems, which have to be addressed further below here. In a universe with a cosmic matter donation which co-expands due to the action of cosmic vacuum energy, matter density $\rho(R)$ decreases with increasing cosmic scales $R_0 \leq R_1 \leq R_2$. This means it performs work with the help of vacuum energy against the gravitational attraction of the cosmic matter field. If it is the vacuum energy which causes this expansion, then it should be expected that, exactly because of this work performance, this vacuum energy is gradually consumed and the vacuum energy density ϵ_{vac} decreases with the cosmic scale R. That, however, would create a conflict with the present standard cosmology which assumes that the vacuum energy density $\epsilon_{vac} = \epsilon_{vac}(\Lambda)$ following Einstein‘s vision is constant [10]. Also this phenomenon would be just the opposite of Newton‘s fundamental theorem: Nulla actio sine re-actionem! (No action without re-action!). Namely: Despite the fact that the cosmic vacuum performs work against the internal cosmic gravity, it nevertheless increases its total energy: a physically paradox situation like in case that mass is transported upwards in the gravity field, and energy thereby is gained. That would infact mean we are in a tail-like "Münchhausen- universe"!

5. Does One have to Face Mass Creation in this Universe?

Often it has already been asked whether something new in form of information or new particles enters the global universe during its expansion. For instance the famous astrophysicist Fred Hoyle in the years after 1948 was fascinated by the idea that in the interest of a cosmic state invariance a cosmic mass generation should seriously be discussed. For his idea of a "steady state universe", taking care of a universe which despite of its expansion does not change its internal status, following Hoyle, mass should be created in a very well dosed and adequate rate. Whatever one is thinking of Hoyle‘s ideas in these days, it is nevertheless most interesting to recognize that the mathematical formulation which was found by Hoyle for the needed mass generation leads to a universe which interestingly enough works analogously to an Einstein- de-Sitter universe with a cosmologic constant Λ[22], if only this constant is replaced by the following, needed mass generation rate $\dot{\rho}$ [23-28]:

$$\Lambda = (\frac{8\pi G\sqrt{3}}{c^5}\dot{\rho})^{2/3}$$

In this relation it seems to become elucidatory that the vacuum energy described by the cosmologic constant Λ, seen from the aspect of its cosmologic action, is equivalent to the mass generation rate required by Hoyle with $\dot{\rho} \sim \rho$ = const. - One may want to ask, where such a context may come from? And how this could seriously be argued for physically? Does this perhaps express the eminent truth, that vacuum energy and mass generation somehow are equivalent cosmic phenomena? In Fred Hoyle´s request for a "steady state universe" this led to a mass generation rate $\dot{\rho}$ which had to be proportional to the actual cosmic mass density ρ, i.e. connected with the special request $\dot{\rho} \sim \rho$ = const!.

In a completely independent consideration which leads to similar contexts, Fischer had ventilated how the gravitational binding energy of the cosmic matter should enter the energy-momentum tensor $T_{\mu\nu}$, i.e. the source tensor of the space-time geometry in the ART field equations [27]. Interestingly enough his considerations show that for a positively curved universe the corresponding entrance $T_{\mu\nu}^{p}$ for the binding energy hereby should be expressed by

$$T^{p}_{\mu\nu} = -C\frac{\rho}{\Gamma}g_{\mu\nu}$$

where $g_{\mu\nu}$ is the metric tensor and C is a constant with a specially selected value which amongst other things contain the gravitational

constant G and the actual curvature radius Γ of the positively curved cosmic space. This elucidates two more things: First there turns out a propotionality of the binding energy and the mass density ρ, and second: the term has a negative sign, has the metric tensor as a factor, and, consequently in the field equations, has the same appearance as the term that in connection with the cosmic vacuum energy by the quantity Λ does enter the field equations. This elucidates an existing connection between vacuum energy and gravitational binding energy which has been overlooked in the cosmic standard model. In addition taking together the timelike tensor components T_{00} and T_{00}^{p} for the vacuum energy and the gravitational binding energy this reveals a surprising connection of matter generation and binding energy expressed by the following resulting expression:

$$\hat{T}_{00} = T_{00} + T_{00}^{p} = (\rho - C\frac{\rho}{\Gamma})g_{00}$$

This expresses something like; the gravitational binding of the cosmic matter represents the cosmologically active, "effective" cosmic matter density ρ^* different from the normal matter density or the proper density ρ by the following expression

$$\rho^* = \rho(1 - C\frac{1}{\Gamma})$$

If now, as consequence of the cosmic expansion, the cosmic curvature radius Γ increases, it thus means that the binding energy and, equivalent to that, the vacuum energy decreases, while connected with that the effective density ρ^* changes according to the following rate

$$\dot{\rho}^* = \frac{d}{dt}[\rho(1 - C\frac{1}{\Gamma})]$$

In case of Hoyle's steady state universe with $d_\rho/d_t = 0$ this means [24]:

$$\dot{\rho}^* = \rho C\frac{1}{\Gamma^2}\dot{\Gamma}$$

One obtains an effective density generation rate which is proportional to the density itself and which is positive at increasing curvature radii Γ.

If one introduces the upper term for the binding energy into Einstein's field equations, then one finds for positively curved universes solutions for which the universe oscillates around an equilibrium scale R_0 with positive $(R \leq R_0)$ and negative $(R \geq R_0)$ vacuum energy density values. Vacuum energy, binding energy and changes of the effective density are thus closely related to eachother, and cannot be seen as independent physical phenomena.

6. The "Zero-Energy"- Universe

To many of the present human beings it would surprisingly enough appear marvelous, if the universe would consist of "nothing". Because in that case one could easily understand that such a world also originates from nothing, and the plagueing question how the world creation could at all have happened in physical terms would have its natural, but trivial answer: The world is nothing, it originates from nothing, and it will forever remain nothing. But how could such an idea make a physical sense? "Nothing" in physical terms means "vanishing energy"! But can one intellectually be content with a model universe that does not represent any energy, though evidently the energies of stars and galaxies added up in this universe clearly seem to represent an enormous amount E of energy? Surprisingly enough, however, the answer to this question in fact is: YES!

Namely indeed this answer could be given, if the many forms of positive energies E in the universe would just be compensated by corresponding amounts of negative energies U, as for instance binding energies represented in this universe, such that in fact a balance could be valid like: $E + U = 0!$.

Whether this might be possible has to seriously be investigated and does lead any way to a universe different from our presently envisioned one. Let us aim at building for that purpose an expression for the total energy $E + U$. Hereby not only the energies have to be summed up over the total cosmic space volume which are represented by the distributed cosmic masses with densities $\rho = \rho(R)$, but in addition the thermal and kinetic energies of these masses have also to be added up which may be done by taking into account the material pressure $p = p_m(R)$. To make this balance complete in addition all contributing parts have to be taken into account besides the baryonic mass density ρ_b, namely the mass density of the dark matter ρ_d and the equivalents of the mass density of the vacuum energy ρ_{vac}. The same procedure has to be carried out with the pressures of these components, since hereby the pressures of baryons, dark matter, and the vacuum equally count in form of $p = p_b + p_d + p_{vac}$. The finally resulting expression for the total energy $E + U$ is proportional to the third power of the cosmic scale R.

In similar steps the gravitational binding energy of this mass- and energy representing constituents have to be calculated by adding up these contributions sphere by sphere in steps $d^U = R^2 dr\, U(R)$. Hereby the expression d^U is a quantity proportional to the fifth power of the cosmic scale, i.e. to R^5. If one now requests that E and U cancel in their sum, this then leads to the following requirement:

$$\frac{3c^2}{2\pi GR^2} = (\rho_b + \rho_d + (\xi - 2)\rho_{vac})$$

where ξ is again the polytrope of the relation between vacuum pressure and vacuum mass equivalent energy density in the form:

$$p_{vac} = -\frac{(3 - \xi)}{3}\rho_{vac}c^2$$

As can be recognized in the upper expression, this request $E + U = 0$ can only be fulfilled, if all mass densities in the universe are inversely proportional to the square of the cosmic scale, i.e. do behave like $\varrho \sim R^{-2}$. This especially means that the mass densities ρ_b and ρ_d have to fall off milder than $\rho \sim R^{-3}$, namely by R^{-2}. This, however, also has the consequence that a matter generation in the universe is needed given by:

$$\dot{\rho}_{b,d} = \frac{\rho_{b,d}}{R}\dot{R} = \rho_{b,d}H$$

The impulsive and spontaneous question, how this mass generation could be explained, and from what energy pool this mass creation is covered, now is easy to be answered,- since now not as in the standard cosmology the vacuum density is not constant anymore, but it decreases with increasing cosmic scale R according to $\rho_{vac} \sim R^{-2}$ which delivers the evident solution $\dot{\rho}_{vac} = -\dot{\rho}$ [24]. This now evidently means that in a zero-energy universe at the expansion vacuum energy has to be transformed into matter. This on the other hand has the consequence that looking into the direction towards the Big-Bang the energy of the universe gradually is transformed into pure vacuum energy. When the cosmic scale R finally has reduced down to the Planck length $R = R_{Planck} = 1.6 \bullet 10^{-33} cm$, it then turns out that then the cosmic vacuum energy attains its absolute maximum value which has been calculated by the quantum field theories: 122 orders of magnitude larger than its present value in the universe [11].

7. The End of the Understood Universe

As most of the present day cosmologists see it, this Big-Bang universe already by its beginning unavoidably requires its "Big-Bang"- typical end. But should present generations of mankind actually be ready to get their end predicted by such a poorly understood universe? This in fact they should better not do! Since for anyone looking a little deeper into these matters, it becomes evident, that even in the frame of the Big-Bang cosmology the entropic end of the universe is not at all clearly predictable. First it has to be clear that the classical thermodynamics can not be applied to this universe, because the latter is an open, not a "closed system"!. For open systems, however, the validity of the prime theorem of thermodynamics of permanently increasing entropies can not be expected. For the sub-systems of this universe like galaxies and clusters of galaxies this may already much better be posssible, though all these subsystems are typical non-equilibrium systems which maintain energy exchange with their cosmic environments, and their entropy clocks, dependent on whether they receive or loose more energy into their environments, can run in the positive or the negative direction. Hereby the biggest relevant cosmic system is the visible star cosmos enclosed into the horizon of cosmic microwave background radiation. Since all stars enclosed by this background are hot radiators with respect to the effective radiation temperature of 2.735º Kelvin of the background, they all can deliver energy to this background what allows them to in fact reduce their entropy [11]. The most essential point why in the universe the entropy evolution happens under conditions different from what is predicted by classical thermodynamics is caused by the fact that in the universe stars, galaxies and clusters play the role of emitters - like atoms and molecules do it in Boltzmann‘s classical thermodynamics. Between the first ones and the second ones there, however, exist essential differences concerning statistical independences which as can be shown have the consequence that the entropy balancing by Boltzmann‘s H-funktion $H(t) = \int f(\vec{v}, t) \bullet \ln[f(\vec{v}, t)] d^3v$ is not applicable anymore. Therefore the entropic end of the universe is by far not easily predictable!

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