Ideas on an Alternative Cosmological World Model with Different Initial Conditions

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Abstract

The actual world model, the "Standard Model of Cosmology" (SMC), which dates back to the 1950s, no longer corresponds to the latest state of knowledge on the cosmos. By way of example, the assumption made in the SMC that the expansion of the cosmos is continually being reduced due to the effect of the gravitation exerted on all the matter in the universe is now contradicted by recent measurements. The reason for the expansion of cosmic space in accordance with Hubble's Law is not physically explained by the SMC but merely stated as a fact. Another example is provided by the "dark phenomena", which make up by far the greatest part of the energy of the cosmos, and exert a dominant influence on its behaviour. In spite of intensive research over the decades to provide answers to these as well as other open issues in cosmology, no satisfactory and plausible answers have hitherto been found. It is indeed time to propose an alternative cosmological world model to the SMC in the light of the latest insights on the universe.

Keywords

1. Introduction

Although a wide range of views exists among the research groups investigating dark matter—as can be seen from the abundant literature available on the subject ([1]-[5]), it is nevertheless possible to recognise a certain preference, namely that dark matter may possibly consist of so-called WIMPs (Weakly Interacting Massive Particles), which have long been the subject of an international hunt. As far as the even more mysterious dark energy is concerned, cosmologists are completely at a loss—they have absolutely no idea what dark energy might be in physical terms. Only one thing is certain: both dark energy and dark matter are of non-baryonic nature!

Notwithstanding this unsatisfactory situation, in order to finally achieve some progress in unravelling these dark phenomena following all the futile attempts in this direction, I propose striking a radically new path that has not been hitherto considered. This new path represents the subject matter in this paper, in which I propose that **the secret of the dark phenomena in the cosmos is concealed in cosmic photons**. I argue this on the grounds that the sole non-baryonic mass known to date is in fact the relativistic mass of photons, from which basis the non-baryonic masses of dark matter and dark energy are derived. This is the starting point of my research work on the dark phenomena of the cosmos.

2. Variable Speed of Light during Transition States of Photons

As far as the constancy of the speed of light in relation to the emission or absorption of photons is concerned, attention should be drawn to the following problem that has hardly ever been touched upon to date:

It is, of course, well known that the speed of light in a dense medium is considerably slower than the speed of light in a vacuum. This effect comes about since the two electromagnetic field constants—ε (permittivity) and μ (permeability)—are significantly greater in a dense medium than in a vacuum. Thus the values for the speed of light in a dense medium are less than in a vacuum—in accordance with **Maxwell's 5th Equation** $c^2 = 1/\varepsilon \cdot \mu$.

When photons cross over from a dense medium into a vacuum, then they must undergo a short transitional phase, during which they are accelerated from the lower speed of light in the dense medium to the higher speed of light in a vacuum. This "acceleration phase" must exist as a very short "transition state", since photons as carriers of energy ($\equiv$ relativistic mass) also possess a specific inertia in common with every other form of energy ($\equiv$ baryonic mass), and cannot therefore be instantaneously accelerated to the vacuum speed of light from a lower value. If this were the case, however, then a discontinuity in the behaviour of the speed of light would occur at the instant of their emergence from a dense medium into a vacuum. This, in turn, would imply the photons undergoing an infinitely large acceleration, which is impossible from a physical perspective. Since the photons possess zero rest mass, the acceleration phase must certainly be of extremely short duration and would certainly not be a trivial problem to verify experimentally![1] If, on the one hand, a short acceleration phase indeed exists for the emission of photons based on this state of affairs, then on the other hand, there must also exist "something", which brings this acceleration phase to an end precisely when the vacuum speed of light has been achieved and then maintains it at this constant value. In concrete terms, this "something" is the braking force of the intrinsic dynamic gravitation of the photons themselves [6] [7]. **A state of equilibrium between the two opposite forces acting on the photon (dynamic gravitation and electromagnetic radiation) is only achieved when the speed of light in a vacuum is reached.** This means that the resulting overall energy of the photon is precisely zero, this representing a fundamentally necessary requirement for the constancy of the speed of light. No state of equilibrium exists between the two opposing forces acting on the photons during every transitional state. During a transitional state, the photons are subjected either to an acceleration—in which case the dominant force acting on the photon is the electromagnetic force, or to a deceleration—in which case the gravitational force is dominant.

In order to avoid any misunderstanding over this issue, it should be expressly pointed out that this transitional acceleration phase should be regarded as part of the photons emission event that does not affect the constancy of the speed of light per se. It is only when the vacuum speed of light is reached—according to the relation $G/c^2 =$ const.—that the photons' transitional state is ended and the state of equilibrium between the electromagnetic and gravitational force inside the photons is achieved. It is precisely at this instant that the photons attain the constant value of the speed of light in a vacuum, which they then subsequently maintain.

The identical event also takes place—in reverse sequence—when photons travelling at the vacuum speed of light cross over into a dense medium and are decelerated to a lower constant speed of light.

Such transition states must have occurred with the primordial photons—albeit to a far greater extent—particularly during the events that took place in the course of the Big Bang, and must have played key roles in the creation of the cosmos.

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[1]There has hitherto been no real reason to search for the acceleration phase of photons in the course of their emission, as—according to generally accepted opinion—such a phase is not supposed to take place for the "fundamental constant of nature c". Based on the arguments set forth above, photons (light) must undergo an extremely short acceleration phase, perhaps even only in the order of nanosecondsor even shorter. In this regard, however, it is not at all certain whether this extremely short transition state of photonsis verifiable (due to Heisenberg's Uncertainty Principle).

3. Hitherto Unsolved Cosmological Problems

No secure or testable knowledge exists concerning the extremely rapid events that took place at the very beginning of the cosmos—but only hypothetical model assumptions. Nevertheless, in order to stimulate an exchange of views on this fascinating subject, I would like to use this paper to express my viewpoint on the extremely rapid events that took place in the first moments of the creation of the cosmos.

According to the doctrine of cosmology valid today (the SMC or the Big Bang Theory), the speed of expansion mathematically (but not physically!) extrapolated back to the world time of t = zero (at the instant of the Big Bang) would have to have been infinitely great and is supposed to have been continually reduced in the course of world time as a result of the gravitation of all the cosmic mass aggregates acting on it. The volume of space occupied by the emerging cosmos also mathematically extrapolated back to the world time of t = zero would have to have been reduced to a point (devoid of dimensions)—which would have had both an infinitely high energy density and temperature as a consequence. These singularities or discontinuities of physical quantities occurring at the instant of the Big Bang have long plagued physicists, cosmologists and mathematicians alike and cast legitimate doubts as to whether such states at the moment of the Big Bang actually occurred (or even could have occurred)[2].

According to the SMC, the expansion of cosmic space with its entire material contents was only started by a driving impulse of extremely short duration provided by the Big Bang and would thus represent a purely ballistic event extending over the entire duration of world time, whereby its course would depend on the strength of the driving impulse and the braking effect of the gravitation provided by the total cosmic mass (*similar to the launching of a rocket into space*). According to the SMC, for the duration of world time, there has only existed a permanent deceleration of the expansion velocity caused by the continual braking effect of gravitation in play. The end scenario for the cosmos also depends on these initial conditions, whether it will continue expanding for all time or collapse in on itself again. A permanently acting driving force for the expansion is ruled out by the SMC.

This concept, however, does not accord with cosmic reality, where no braking effect on the expansionary process is discernible. In fact the reverse is true: At spatially and thus temporally extremely remote distances, the expansion of the early cosmic structures appears to be proceeding at an accelerating rate[3]. Notwithstanding this, a decelerated expansion of the cosmos after a world time of 13.8 billion years is out of the question.

There is yet another argument, which conflicts with the currently applicable doctrine of cosmology: from Paper [8], Chapter 4, it is clear that the expansion of the cosmos does indeed possess a continually acting driving energy—namely cosmic radiation energy (the Cosmic Microwave Background Radiation—CMB). Similarly, an impulse provided by the Big Bang—irrespective of how brief a duration—as the sole cause of cosmic expansion also does not correspond to cosmic reality.

Finally, from both a physical and philosophical perspective, an infinitely high expansion velocity of a just emerging—but not yet existing in a real form—punctiform cosmic space is an impossibility, let alone surpassing every human imagination. For this reason, this assumption can also not have accorded to reality (*refer to the note in* 4.1).

Although according to the current state of knowledge, the non-baryonic "**dark matter**" (ca. 27%) in the part of cosmic space perceivable to us is approximately 5.5 times as large as baryonic matter (ca. 5%), science has not hitherto found a generally accepted explanation as to what "dark matter" actually consists of. The same is also true for the utterly mysterious "**dark energy**", which is supposed to make up the greater part of the energy of the cosmos (ca. 68%). It is absolutely essential that to some extent—at the very least—a new world model is able to provide information on dark matter and dark energy, as it is not acceptable for us to remain ignorant of the nature of the overwhelming majority of cosmic space. Although a physically founded and plausible explanation of the creation and nature of dark matter and dark energy can be found in Paper [9], that paper is as yet too little known and therefore still subject to scientific confirmation.

Another problem is the fact that the SMC does not possess an explanation for the expansion of cosmic space

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[2]The "singularities" mentioned both in specialist literature on cosmology and in this paper represent a purely mathematical concept that can possess absolutely no physical foundation whatsoever. Infinitely high values of physically existing quantities are not possible!

[3]According to the insights gained by Saul Perlmutter (for which he was awarded the Nobel Physics Prize in 2011) et alia, there exists an accelerating expansion of cosmic space in the most remote cosmic structures. As described in paper [9], these remote cosmic structures exhibit an accelerated expansion due to a strong gravitational attraction exerted at the boundary of the cosmos. For more information on this subject, refer to the rich cosmological specialist literature on Einstein's Cosmological Constant, Vacuum Energy, Dark Energy and Antigravitation, e.g. via the appropriate references in "Wikipedia".

in accordance with **Hubble's Law**. One possible explanation, however, is presented in Paper [8][4].

Furthermore, the so-called "**inflationary expansion**" of cosmic space in accordance with the SMC casts doubt as to whether this purely "pasted-on" explanation actually accorded to cosmic, *i.e.* physical reality (*refer to the relevant remark in* 4.6). Nevertheless, there can be no doubt that cosmic space with its energy content did undergo an extremely rapid accelerated expansion phase in the initial stages of the cosmos, and this expansion phase still awaits a physical foundation.

According to the SMC, the cosmos is finite but unbounded; *i.e.* the concept of "outside the cosmos" does not exist and is meaningless. From a space-time perspective, the cosmos is represented as the "three-dimensional surface of a four-dimensional physical entity", a concept that is not easy to imagine in physical terms.

What, though, if the cosmos does indeed possess a physical boundary? In that case, the SMC would in this respect be incorrect (*refer to Chapter* 4.5).

For all the reasons set out here, one cannot but doubt the correctness and appropriateness of certain premises contained in the SMC, which, furthermore, are only able to explain some 5% of the observable universe at the present time due to the dark phenomena representing by far the great majority of the cosmos. Since no activities are known to me that are pursuing additions to or corrections of the SMC as their goal, I put forward a few proposals below, which are aimed at creating an alternative cosmological world model.

4. Different Initial Conditions for an Alternative Cosmological World Model

4.1. Initial Conditions at the World Time $t = 0$ of the Creation of the Cosmos

Given that some of the extreme assumptions made in the SMC are patently incorrect, then it is necessary to make different assumptions that are better able to explain the events concerning the creation of the world. Any new or adapted world model has to take into account the present-day knowledge gained into the expansion of the cosmos, while, in particular, being able to physically explain the extremely rapid expansion of cosmic space in the early stage—something that the SMC with "inflationary expansion" is unable to achieve. Furthermore, a new alternative world model must be of an "all-encompassing" nature and should therefore include information on the current actual state of scientific knowledge relating to "dark matter" and "dark energy". An extremely hot initial state of the primeval cosmos containing the greatest possible energy density remains incontrovertible.

The initial state of cosmic creation (at world time $t = 0$) hitherto assumed in the SMC is characterised by:
- an infinitely large velocity of expansion;
- infinitely large physical values (singularities) in a "punctiform (non-dimensional) space";
- the beginning of "cosmic chronology" (time did not exist before the Big Bang).

As a possible (and also more probable) alternative to this, only a contrary initial state can come into question, namely one characterised by:
- **an expansion velocity starting from zero**, *i.e.* a very short transient state of the extremely compressed world substrate at rest;
- **the existence of a "primeval cell of cosmic space"** containing this extremely compressed world substrate;
- **a time before the Big Bang**, in which the countdown to the Big Bang is proceeding. Cosmic chronology (*i.e.* relating to this particular cosmos) would then begin with the Big Bang.

As mentioned in Chapter 2, the speed of light in a dense medium, such as glass or water, is considerably lower than in a vacuum. In the light of the initial situation of the cosmos with its highest mass density prevailing up to the instant of the Big Bang, the primordial photons thus have no possibility of moving, because they are confined in the extremely dense world mass[5]. For the primordial photons and the compressed world mass, the situation immediately before the Big Bang is comparable with an extremely dense black hole, which receives no supply of energy "from outside" and continues to implode until a final gravitational collapse—together with a

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[4]Here I briefly mention that in the course of world time, the constant increase in entropy of all cosmic photons causes their energy to steadily decrease and hence their wavelength and spatial volume to steadily increase uniformly (isotropically) in all directions. Since the distance between the photons is equal to their wavelength λ (*i.e.* each photon "impacts" on the photons in its direct vicinity; no energy-empty or field-free space exists between the photons), then an "externally" directed radiation pressure is created as a result of the uniform increase in the wavelength λ of all photons in cosmic space, which then drives the expansion of the cosmos. By this means, the expansion of the cosmos is isotropically driven by the entirety of all the cosmic photons (via the cosmic background radiation) in accordance with Hubble's Law.

[5]In contrast, photons in our sun require some 10,000 years to travel from the core of the sun to its surface—due to their constant collisions with material particles. Photons in a vacuum, on the other hand, can travel completely freely at the vacuum speed of light. During the initial state of the cosmos, however, no vacuum exists but instead the greatest energy—mass density possible in the creation process.

subsequent supernova—occurs, thus initiating the most dynamic events of the Big Bang. In this process, the implosion of the extremely dense world substrate is transformed in the course of a short transitional state into a vehement explosion, *i.e.* a reversal of the energy flow from compression to expansion takes place, during which the turning point entails a state of rest of the energy flow of extremely short duration. This turning point corresponds to the instant of the Big Bang (with zero expansion velocity) and the beginning of the cosmic calendar with $t = 0$.

The cause of the Big Bang was therefore the preceding gravitational collapse of the entire imploding world substrate with the subsequent primeval supernova as the actual Big Bang. This scenario for the creation of the cosmos conforms to its probable end scenario (*refer to* 4.2.4) and corresponds to the model representation of a "pulsating cosmos".

Note: *When completely new life is created, then only as a very small beginning and only taking form in the course of time. Each living being starts with a single cell, each structure starts with a single building stone. Even each speed starts from a state of rest. A beginning from an infinite size is neither physically (materialistically) nor philosophically (logically) possible. For this reason, it is not possible for the cosmic expansion to have begun with an infinite speed of expansion.*

If the creation process is assumed to be based on a "single primeval cell of cosmic space", then this cell possesses a scale, down to which the entire world substrate had been previously compressed as a result of supergravitational collapse, only to then expand in an unbelievably enormous explosion. This cell represents the smallest possible space in the history of the cosmos, from which the totality of the cosmos then developed in the course of world time, and—some 13.8 billion years later—has now reached the stage we perceive today. **By this means, there would have been no singularities at the start of cosmic expansion (at world time $t = 0$) and physical quantities appear with finite—albeit extremely high—physical properties, as may better have accorded to reality**. Thus physically explicable states would already have existed at the beginning of cosmic history.

That the expansion of the cosmos against the counteracting effect of supergravitation ensued on the world substrate at rest, is also confirmed by the hitherto scarcely noticed fact that—following an extremely short and rapid acceleration phase by the world substrate—by far the greatest proportion of the overwhelmingly dominating cosmic radiation energy had been almost completely exhausted, since this radiation energy provided the total energy required to drive the start and further course of the expansion of the cosmos—and indeed continues to do so.

Very soon following the start of cosmic expansion, the energy of the material particles (initially only present in traces) gained the upper hand over the residual radiation energy (cosmic background radiation) with the result that the initial radiation-dominated era of the cosmos gave way to the material-dominated era. What other reason could there be for practically all of the cosmic radiation energy (with the sole exception of cosmic background radiation) to have been "consumed" so rapidly, if not as a result of the start and further course of the expansion of the cosmos by performing the entire work of primordial expansion required? The SMC provides no explanation for the nearly total consumption of the cosmic radiation energy that ensued in the early stages of the universe.

This energy flow at the very beginning of the cosmos is a strong argument in favour of an extremely energetic beginning of cosmic expansion ensuing from a state at rest. First of all, it was necessary to overcome the compressive and binding force of supergravitation on the extremely dense world substrate at rest, in order to launch the rapid expansion of the latter. There is no other explanation for the enormous consumption of energy in such a short time.

The SMC, on the other hand, assumes that the expansion of the cosmos at time $t = 0$ ensued with an infinitely high expansion velocity, requiring no work at all to be performed by the primordial photons. If this had indeed been the case, then the cosmic radiation energy would still continue to be the dominating force, since the entire work of expanding the cosmos for the duration of world time would have been achieved by an impulse of extremely short duration originating in the Big Bang.

4.2. The First Effects of Energy in the Initial State of the Cosmos

4.2.1. The Effects of Energy during the Brief Epoch of Supergravitation

In the very moment that primordial electromagnetic energy appeared with the Big Bang, the gravitation corre-

sponding to this quantity of energy also appeared in the dynamic cosmos in the form of "supergravitation". The overall "quantum of supergravitation" is equivalent to the overall "quantum of primordial electromagnetic energy". Since that moment, no form of energy without gravitation—as an inseparable permanent companion of the energy-filled cosmos—has existed in the cosmos for the entire duration of world time. This critical brief era of supergravitation, which is so essential for the subsequent development of the entire cosmos, is based on the following assumptions:

The supergravitational state is identified by the emergence both of the **Gravitational Constant G_{sup}**, orders of magnitude greater than G ($G_{sup} \gg G$), and the **constant speed of light c_{sup}**, orders of magnitude greater than c ($c_{sup} \gg c$). Here the relationship

$$G_{sup}/c_{sup}^2 = G/c^2 = \text{const} . \, (\textit{refer to } [6], \textit{page } 1224)$$

only applies from the moment, at which the state of equilibrium between the two opposing elemental forces within the primordial photons (primordial electromagnetism and dynamic supergravitation) is achieved—this being the case when the constant value of c_{sup} is reached.

Until this state of equilibrium is reached, however, a transition state of the primordial photons exists with a rapidly accelerating speed of light (*refer to Chapter* 2). This transitional acceleration phase of the primordial photons should be regarded as part of the emission process of the photons from the extremely dense world substrate at rest.

For this reason, at the onset of cosmic history (world time $t = 0$) the expansive force of the primordial photons by far outweighs the gravitational cohesiveness of the world mass. This leads to the breaking up of the strong gravitational force binding the world substance together and—consequently—to the beginning of cosmic expansion from the world substance at a state of rest.

Because of the enormous significance of the events that took place pertaining to the Big Bang for our present-day conception of the cosmos, I shall now address this epoch in more detail—even at the risk of partly repeating myself:

The electromagnetic force of the primordial photons suddenly released in the Big Bang causes an **extremely rapid accelerated expansion of the protoplasm as the first energy effect** of the newly emerging cosmos and with it the protoplasmic structure of cosmic space, this corresponding to the so-called "inflationary expansion" term used by cosmologists. In my opinion, this primordial acceleration of the protoplasm itself represents the actual "Big Bang event", underlying the behaviour (described below) of the two contrary acting elemental forces (primordial electromagnetism and dynamic supergravitation):

The dynamic supergravitational force of the primordial photons would not have been immediately able to act as a stabilising force during this period of enormous acceleration of the primordial photons, because the state of equilibrium between the opposing dynamic proto forces within the primordial photons had not yet been achieved (*refer to Chapter* 2). Therefore at the very beginning of the cosmic expansion, the force of the "primordial electromagnetism" prevailed. The "**first transition state of primordial photons**" must thus have occurred at the instant of the "Big Bang", when the cosmic expansion began, starting from the expansion velocity zero and simultaneously bringing with it the acceleration phase of the primordial photons and the cosmic space.

The primordial photons originally trapped in the incredibly dense "cosmic egg" accelerated until a state of equilibrium was achieved between the force of dynamic supergravitation and the force of primordial electromagnetism. We can therefore say that **the first transition state of the primordial photons came to an end at the instant, at which the constant speed of light $c_{sup} \gg c$ was achieved in accordance with the relationship $G_{sup}/c_{sup}^2 = \text{const}$**. The constancy of the highest speed of light in the cosmic history c_{sup} was then maintained for as long as G_{sup} remained constant.

Note: *If supergravitation had been able to achieve its full effect as a stabilising force at exactly the same instant as the Big Bang occurred, then the acceleration phase of the primordial photons would not have taken place, but an immediate state of equilibrium between the two opposite (and equal) forces would have ensued instead, resulting in a total absence of motion (i.e., the primordial photons could not have achieved any external action). The "positive expanding" electromagnetic energy and the "negative contracting" gravitational energy would have cancelled each other out at the same exact instant when the Big Bang occurred. In such a situation, the resulting energy of the two opposing quantities would be zero and no energy would therefore have been available for the creation of the cosmos. Since, however, the acceleration phase of the primordial photons in this very early stage is an absolute necessity to make the creation of the cosmos possible, an imbalance of forces*

in favour of electromagnetic energy must thus have existed at the very beginning in order to be able to set in motion the acceleration of the world mass.

Once the state of equilibrium had been achieved, the two contrary acting forces of the primordial photons (primordial electromagnetism and dynamic supergravitation) possess an equal (and opposite) energy given by **Planck's Formula $E = h \cdot \nu_{sup}$** (ν_{sup} *is the frequency of the primordial photons during the state of supergravitation*) and the speed of light c_{sup} is then constant from this time. The resulting energy acting on the primordial photons is thus zero, and there is then no other force acting on the photons, which could affect them in any way (*i.e.* by accelerating or decelerating them)[6]. Following the previous phase of acceleration, the expansion of the cosmos then proceeds with the highest constant speed of expansion c_{sup} for the short period comprising the duration of G_{sup}.

In contrast to the "inflationary expansion" depicted by the SMC (*refer to the remark in Chapter* 4.6), the model expounded here deals with the extremely rapid expansion of the cosmos in terms of two different phases: First an accelerated expansion from the world time $t = 0$ until the fastest speed of light ever achieved in the history of the cosmos is reached—c_{sup}. Second, from this point, the expansion continues with the highest constant value of the speed of light c_{sup} until the end of the era of supergravitation G_{sup} is reached.

At the end of the era of supergravitation, the values both of G_{sup} and c_{sup} must have been gradually reduced in the course of a "second transition state" into the values of the gravitation constant G and speed of light c that we are familiar with today. The instant, at which this second transition state ended, represents the starting point of application of the current doctrine of physics.

As mentioned earlier, the "total amount of gravitation" in the cosmos is in conformity with the "total amount of energy" in the cosmos. Gravitation has the same unknown origin as energy. For this reason, since there exists a Law on the Conservation of Energy (*First Law of Thermodynamics*), then—in parallel to this—there must also exist a **Law on Conservation of Gravitation**[7] [6]. As is the case with energy, gravitation can be neither created nor annihilated—a fact that also points to it having the same origin as energy.

In exactly the same way as the entire cosmic space is completely filled with energy (*nowhere does there exist an area of space completely devoid of energy—as a minimum requirement*, "*quantum fluctuations*" *are continually taking place*), cosmic space is also suffused with gravitation.

Before addressing the subject of the "first occurrence of dark matter in the early events of the cosmos" (refer to Chapter 4.2.3), it is first necessary to make some general statements concerning gravitation, in general, and dark matter, in particular.

4.2.2. General Statements on "Dark Matter" and Gravitation

The non-baryonic static gravitational field in the cosmos is generally interpreted by physicists and cosmologists as an effect of so-called "**dark matter**", which only manifests itself in an external form via its gravitational interaction, albeit without revealing the nature of the "matter" causing this gravitation. How dark matter is formed and what it consists of is an issue that physicists and cosmologists have not been able to clarify to date—and indeed some scholars doubt the existence of dark matter with non-baryonic mass altogether. Nevertheless, there is general agreement that some form of non-baryonic static gravitational field of unknown origin exists in the cosmos.

The expression "dark matter" is in widespread use in the specialist literature and is also used in this paper as a synonym for the "non-baryonic static gravitational field" present in the cosmos.

In [7], I take the view that each photon consists of two opposingly acting components of quanta—namely an electromagnetic and a gravitational quantum, the forces associated with them existing in a state of equilibrium at the constant speed of light. In these circumstances, there is no resulting force acting on the photon (a necessary requirement for the constancy of the speed of light). The non-baryonic dynamic gravitation of the photons itself is a property of their gravitational quanta.

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[6]A general consequence of Einstein's Theory of Gravitation (General Relativity) is that the total energy in a physically closed system is always zero. "Positive energy", whose essence is in the expansion (electromagnetism), and "negative energy", whose essence is in the implosion or holding together (gravity), mutually cancel each other out exactly. As these two opposite forces of nature are of equal strength in a physically closed system, a stable state of equilibrium therefore exists between them and the resulting total energy is zero. The cosmos as a whole (as well as each photon in it as an elementary component of the entire cosmos) is therefore a physically closed system.

[7]**Law of Conservation of Gravitation: "For each transformation of energy, the quantum of gravitation corresponding to the converted amount of energy in each case is also transferred, so that the effect of the original quantum of gravitation existing before the energy transformation is conserved overall".** This conservation principle possesses the character of a hitherto unknown law of nature!

Once the cosmic photons performing the work of expansion exhaust (*i.e.* transform) their energy, then the gravitational quanta are no longer part of the dynamic quantum duality of the "photon drive", but are converted into a hitherto unknown static physical quantity denoted as "dark matter".

> **Dark matter is therefore the "static remnant" of the converted dynamic gravitational quanta of cosmic photons, which have been (and continue to be) used for the permanent expansion of the universe. In any case, however, dark matter is an offspring of the cosmic photons. Dark matter only manifests itself as "non-baryonic static gravitative field energy", distributed in varying densities throughout the entire cosmos.**

Since the cosmic energy of radiation subsequent to the primordial nucleosynthesis has possessed (and still possesses) a constantly falling level of energy, the dark matter resulting from each exhausted cosmic photon would—of necessity—have to be extremely light in mass (equivalent to an extremely low gravitational energy), provided that it is indeed "material with non-baryonic mass" in nature.

Note: *In view of the fact that the expansion of the cosmos is continuing—with the cosmic microwave background radiation (CMB) as the driving force* [8], *dark matter (with decreasing density) will be continually produced for as long as the cosmos goes on expanding*.

Following work performed by a photon, **the non-baryonic, dynamic gravitation of photons cannot simply vanish without a trace or be annihilated, but remains conserved in the transformed form of non-baryonic static gravitation of dark matter** (Law of Conservation of Gravitation).

The non-baryonic static gravitation itself is simultaneously deposited in cosmic space where the cosmic radiation energy has actually performed the work of expansion, *i.e.* in the uniformly expanding cosmic space throughout the universe. **Dark matter in the form of gravitational field energy participates in the expansion of cosmic space, being gradually attenuated in the process**.

From today's scientific perspective, only one type of gravitation exists, *i.e.* static gravitation, while the "dynamic gravitation of photons" [7] is still an unknown phenomenon (or has not yet been noted by the scientific community). Static gravitation is "decoupled" from the other fundamental forces of nature at a very early stage. This, however, only applies to the by far prevailing non-baryonic static gravitation, which was the first fundamental force to decouple from the other fundamental forces (as a result of the first symmetry-breaking phase transition) as early as the Planck Era and since that point in time has—as it were—led an "independent existence". For the non-baryonic dynamic gravitation of photons, on the other hand, the above statement does not apply—it remaining inseparably associated with the photons until they are consumed, *i.e.* converted by performing work (*in this regard refer to footnote* 10). Neither does the statement apply to the baryonic gravitation of the elementary particles (with baryonic mass)—this also cannot decouple.

In fact, two types of gravitation exist: the free (unconstrained or decoupled from the world substrate) non-baryonic static gravitation, referred to as dark matter, and the gravitation bound (or coupled) to its elementary particles! (*Other ways to distinguish them*: "*static ↔ dynamic gravitation*" as well as "*baryonic ↔ non-baryonic gravitation*").

Because non-baryonic static gravitation leads an independent existence in the cosmos, *i.e.*, it is decoupled from the other fundamental forces of nature, I assume that it does not necessarily require any massive non-baryonic material—irrespective of how it may have been created—in order to be able to independently (autonomously) exist as non-baryonic static gravitation. Although this would imply that no massive dark material exists "per se", non-baryonic gravitational field energy does, however, exist as a static transformation product of the dynamic gravitation of the exhausted photons. In other words: Once cosmic photons have performed work (by expanding space), their non-baryonic dynamic gravitation is decoupled from the photons and converted into non-baryonic static gravitation, which then leads its own life, independently of the other fundamental forces. In my opinion, **dark matter does not consist of massive particles!**

The property of dark matter—namely that it also participates in the expansion of cosmic space—is a pointer to dark matter of necessity being of a non-massive nature.

4.2.3. First Occurrence of "Dark Matter" in the Early Events of the Cosmos with a Perspective on the Mysterious "Dark Energy"

With the onset of the Big Bang and the work performed by the primordial photons in carrying out the extremely energy-intensive accelerated expansion, the so-called **"dark matter" already emerged as another form of energy in the state of supergravitation with its greatest density (intensity) in the entire cosmic history**.

This first example of dark matter created had decoupled very early on from the remaining expanding world substance. It completely enveloped the early cosmic space in the form of a dense—albeit elastic—static gravitational wall and represents the external boundary of the cosmos. The complex events leading to the creation of dark matter are described in detail in Report [9]. In short:

> **Dark matter with its greatest density in the history of the cosmos is the "static gravitational residue of non-baryonic nature" (metaphorically expressed as the "static combustion residue" of the exhausted photons) of the primordial extremely energetic cosmic radiation energy, which was almost totally consumed during the accelerated expansion of the extremely dense world substrate.**

This extremely strong gravitational energy then existing at the boundary of the cosmos has the effect of exercising a powerful attraction on the nearby cosmic structures. Seen from our perspective (from the inner cosmos), we perceive an **accelerated expansion of the "distant cosmic space"**, this perceived phenomenon currently attributed either to **"antigravitation" or "dark energy", producing an accelerated expansion of the "distant cosmic space"**. In my opinion, however, both of them are erroneous interpretations. In specific terms, what we are dealing with here is a **"gravitational instability"**, acting from the boundary of the cosmos with a strong attraction on the baryonic masses located near to this boundary.

According to the current perspective of cosmology in relation to the very early formation of the first stars and galaxies, it is only possible to explain the early formation of cosmic structures in terms of the existence of significant quantities of dark matter already at this very early stage. The formation of the first galaxies solely due to the gravitation of their own baryonic masses would only have ensued much later—if at all—due to the lack of sufficient baryonic gravitation.

How and in what quantities the dark matter was created and what it consists of, represents a mystery, to which cosmology to date has provided neither a specific insight nor an explanation. As described at the beginning of this chapter, by far the greatest part of dark matter was created immediately in the events of the Big Bang and subsequent quantum era with its greatest density and intensity in the entire cosmic history—thus being available to the full extent for the early formation of cosmic structures. This is a radical insight, shedding new light on the early formation of galaxies.

As the baryonic gravitation of the cosmic masses is permanently associated with them, this gravitation would be able to "capture" any unassociated (free) gravitation (in the form of dark matter) in its vicinity, resulting in a significantly more intensive gravitational cohesion for the galaxies, than is generally identifiable today.

4.2.4. The End of the Expansion Phase of the Cosmos

At the end of the expansion phase of the cosmos, when the entire cosmic radiation energy has been consumed (*i.e.* exhausted) thereby depositing its gravitational energy in cosmic space as dark matter, the expansion of the cosmos has then achieved its culmination (zenith) with a subsequent—albeit temporary (transient)—state of rest. By the end of the expansion phase of the cosmos, the baryonic matter has all been dissipated and all that remains is extremely attenuated dark matter in the form of a static non-baryonic gravitational field, *i.e.* gravitational field energy—and nothing else at all. The temperature of cosmic space has then reached its lowest possible value (close to absolute zero). It can therefore be assumed that the "dark matter" in the cosmos—starting from the boundary with its greatest density of dark matter—starts to compress, and with it, the now extremely enormous cosmic space (enveloped by this boundary) filled with dark matter of far lesser density also implodes. This implosion ensues because there is no more expansive cosmic background radiation available to counteract the process—the "internal pressure of expansion" of the cosmos has been completely exhausted. This, incidentally, is also the reason why the implosion ensues in an accelerated manner, as no counteracting force exists to limit (or slow down) the speed of implosion (in contrast to the accelerated expansion directly following the Big Bang).

This process of implosion will ultimately result in a gravitational collapse (Big Crunch) with a subsequent primordial supernova—*i.e.* a new Big Bang representing the beginning of the cosmic game anew. This idea corresponds to a model variant of the "oscillating cosmos". This process would then provide a scientifically stringent explanation for the onset of a possibly never-ending cycle of cosmic history. Even an oscillating universe, however, must have had a beginning, since infinities do not (and indeed cannot) occur in temporal physical events! Whether this beginning just happened to have taken place some 13.8×10^9 years ago, or alternatively, this current cycle is merely the most recent of many that have occurred before, does not change the fact that the

beginning of cosmic creation is a mystery irrespective of when it ensued.

Note: *This cosmological world model of an "oscillating cosmos" is not new, but rather a variant of the ballistic world model of the SMC. In order for this case to occur—according to the SMC, the gravitational force of all the cosmic masses acting to brake the expansion must be greater than the expansive force emanating from the Big Bang, thus enabling the expansion of the cosmos to be brought to a halt sometime (in the distant future), and then reverse the process to collapse in on itself. This model, in my opinion, is extremely unlikely.*

The entire cosmos is an energy effect, consisting solely of energy, because nowhere in the cosmos does a space completely devoid of energy or gravitation exist. In this alternative world model with the different initial conditions presented here, cosmic energy is completely converted into dark matter (*i.e.* into a non-baryonic, static gravitational field) until the end of the expansion phase. Since from this time on, electromagnetic radiation no longer exists to counteract the gravitation, the dark matter thus starts to compress, thereby setting in motion the implosion of the cosmos. The dark matter itself remains preserved throughout the entire duration of the implosion phase—becoming increasingly dense with time (Law of Conservation of Gravitation)[8].

In contrast to the ballistic world model of the SMC, this alternative model features a short period of a state of rest at the end of the expansion and the subsequent implosion only after the complete exhaustion of the electromagnetic radiation energy acting in an expansive manner.

4.3. The Dynamic Gravitation of Photons as Locally Acting Gravitational Radiation in Comparison with the "Free" Gravitational Waves of Cosmic Origin That Are Predicted in Einstein's GTR

Following the original creation of the cosmos consisting only of the most extreme form of dynamic radiation energy, no "static gravitation" could have existed during the Big Bang Phase or shortly afterwards. In this quantum era, the supergravitation of the primordial photons was as dynamic in nature as the photons themselves and can therefore only have been created by means of gravitational quanta.

The photons' dynamic gravitation remains conserved for the total lifetime of the photons, which are the oldest and longest elementary particles in existence. The physical processes occurring in the earliest phase of the cosmos during the quantum era, are even today still taking place in the photons (in qualitative terms), representing virtually a "remnant left over" from that quantum era.

Without exception, the gravitation of a photon experiences the same speed or dynamics as the photon itself, as it (*the gravitation*) is inseparably associated with the photon. Therefore the gravitation of a photon must appear locally (within the photon) as a high-frequency gravitational radiation resonating with the same frequency as the photon itself (it is—as it were—"clocked" by the latter) [7]. For this reason, the dynamic gravitation of the photons must also be quantised, this being implicitly confirmed by the Maxwell Wave Equations [10]. The equation for the energy of electromagnetic radiation ($E = h \cdot \nu$) must therefore also apply to the high-frequency gravitational radiation associated with the photon. Thus **at the constant speed of light, the resulting energy of each photon is always zero**.

A photon's dynamic gravitation is of non-baryonic nature and remains intimately interrelated (linked) with the photon until the photon is expended or converted by performing external work (e.g. in the expansion of cosmic space). As the processes at work inside a photon lie beyond our capability to determine from a metrological perspective, is it not possible to determine the intrinsic high-frequency gravitational radiation from our perspective. Conclusions on the events taking place inside a photon can only be drawn from the external static effect produced by a photon following an energy transformation, as a result of which the dynamic gravitation of the photon, which has been converted into non-baryonic, static gravitation (Conservation of the Law of Gravitation), becomes perceptible to us in cosmic space and is known as dark matter.

In contrast to the high-frequency "dynamic gravitation of photons" in the Giga-Hz range, the gravitational waves of cosmic origin predicted by Einstein's General Theory of Relativity are low-frequency in nature (approx. in the 1 to 1000 Hz range) and thus extremely low in energy (*i.e.* ca. 10^9-times weaker than CMB-radiation). Notwithstanding decades of intensive international research, it has not proven possible to date to conclusively detect the existence of gravitational waves, which are supposed to represent a **"perturbation of**

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[8]At the end of the expansion phase of the cosmos, the entire radiation energy hitherto driving the expansion—including the already dissipated baryonic matter—has been converted into dark matter. In this (apparently) final stage of the cosmos, there exists only a non-baryonic gravitational field of varying density (and otherwise nothing at all) to initiate and maintain the implosion phase.

spacetime", by means of mechanical detectors. For this reason, it is justified to cast doubts as to whether cosmic gravitational waves actually exist or—if they do indeed exist—whether they are, in fact, so weak that they cannot be recorded.

If the **nature of gravitation** is considered, consisting of a continual striving for contraction, *i.e.* in attracting or compressing each and every form of energy, then based on this it is possible to draw the conclusion that a "free expansive gravitational radiation" (with no additional electromagnetic components) cannot exist, since this would completely contradict the nature of gravitation and would, of necessity, have to collapse in on itself into a (small) black hole, since there no longer exists any counteracting force to prevent the collapse. This behaviour is analogous to the gravitational collapse of an extremely compressed material. Nevertheless, in order for cosmic gravitational waves—*assuming they actually exist*—to be able to freely expand in cosmic space at the constant speed of light, they require a corresponding component of electromagnetic radiation to act as a driving motor (to use the analogy). Only in this case can a state of equilibrium between the two opposing fundamental forces be established, which is a **basic requirement for the free propagation of gravitational waves at the constant speed of light**. If that were true, cosmic gravitational waves would have to expand in exactly the same manner as electromagnetic waves. It therefore follows that gravitational waves could only be distinguished from the familiar electromagnetic radiation by their frequency range—at the lowest end of the electromagnetic radiation spectrum (*i.e.* ca. 10^0 to 10^3 Hz).

The energy of this low-frequency gravitational radiation can therefore also be calculated from the equation $E = h \cdot \nu$, because one physical phenomenon cannot be described by two different equations, which differ only in the frequency range. This type of cosmic gravitational waves would be of extremely low energy and subject to the Maxwell Wave Equations—but not to the General Theory of Relativity. This may well be the reason that it has hitherto not been possible to detect cosmic gravitational waves by mechanical detectors.

4.4. Transition from the Radiation-Dominated Era to the Material-Dominated Era

The time, at which the transition from the radiation-dominated era to the matter-dominated era occurred, is a key factor for the course of events subsequent to the Big Bang. In my opinion, this transition ensued at a very early stage—*i.e.* shortly after the era of supergravitation during the period, in which the primordial nucleosynthesis occurred following the creation of stable hadrons. This would have been in the first approx. 3 minutes of the existence of the cosmos.

The following **Table 1**, which has been taken from the German-language website: www.der-kosmos.de/nser_universum.htm shows the early stages of the young cosmos. Although it is based on the SMC, it differs from it by adopting recent insights and depicting the transition from the radiation-dominated era to the matter dominated era at a significantly earlier time than previously assumed in the SMC.

Table 1. The development stages of the cosmos.

Quantum gravity epoch	Grand Unification epoch	Quark epoch	Lepton epoch	Photon epoch			
Radiation-dominated era				Matter-dominated era			
Plank era: Laws of physics unknown	Grand Unified Theory Epoch: matter dominates antimatter	Electroweak era: dominated by quarks and anti-quarks	Hadrons & leptons era: Quarks form protons, neutrons & baryons	Protons & neutrons combine to form hydrogen, helium, lithium & deuterium nuclei	Radiation era: strong coupling of matter & antimatter	Matter & energy decouple. Cosmos becomes transparent for CMB*	Stars, quasars, proto-galaxies form. Stars begin to breed heavy elements
10^{-43} secs	10^{-35} secs	10^{-10} secs	1 second	3 minutes	300,000 years	1 billion years	

*CMB: Cosmic Microwave Background radiation.

From the above representation of the early stages of the universe, it can also be seen that the transition from the radiation-dominated era to the matter-dominated area ensued in a period from approx. 1 second to 3 minutes.

The SMC, on the other hand, takes the view that this transition took place after a world time of ca. 3 to 4 × 10^5 years at a temperature of cosmic space of ca. 3 to 4 × 10^3 K, when the previously free electrons recombined with the protons, thus making the cosmos "transparent".

As previously described, the SMC also assumes that the maximum energy of motion of the cosmic world mass already existed in the moment the Big Bang occurred (*i.e.* an infinitely high speed of expansion extrapolated back to time $t = 0$) and that it has subsequently undergone continual deceleration due to the effect of gravitation—a process, which, although according to the SMC should still be continuing, does not accord to reality. The cosmic energy of radiation itself is not required for the expansion of the cosmos, since according to the SMC no force exists to support the expansion. For this reason, the SMC is not able to explain why the transition from an extremely radiation-dominated era to a matter-dominated era ensued at such an early stage—whereby matter played a completely insignificant role compared to radiation energy immediately before the transition!

4.5. The Boundary of Cosmic Space

As already mentioned above, the first permanent impression left by the Big Bang is the rapidly increasing young cosmic space enveloped by the super strong dark matter, which represents the physical boundary of the cosmos. There are, however, other arguments in favour of a physical boundary of the cosmos:

- There is absolutely no doubt at all that **the cosmos represents a three-dimensional energy effect**[9] over the entire duration of the universe. However, as each energy effect is restricted in space, the cosmos as a whole must also be restricted and have a boundary.
- Since the cosmos is—according to the current state of science—a **"physically closed system"**, logic alone requires that it possess a "physical closure" that expands along with cosmic space.
- The completely isotropic cosmic background radiation, which corresponds precisely to **"Planck's cavity or black body radiation"**, may be considered as evidence of an existing physical Boundary. In this context there arises the interesting question of whether the cosmic background radiation could be as precisely isotropic as it has turned out to be, if the cosmos did not possess a physical boundary.
- The gravitational residue that was first of all deposited in the early cosmic space by the most energy-intensive primordial photons consumed at the Big Bang for the purpose of "jump-starting" and accelerating the cosmic expansion is a convincing candidate for the physical boundary of the universe. This initial gravitational residue produces an intense static gravitational field that has an effect similar to an expandable, dense rubber covering or envelope, holding the cosmos together gravitationally despite the latter's constant expansion. The electromagnetic cosmic background radiation is therefore able to develop an isotropic radiation pressure, which would not be the case in the absence of such a boundary to the universe. It is for this reason that the cosmic background radiation is, in fact, a Planck's cavity radiation existing in thermic equilibrium!

4.6. Summary of the above Description of the Initial Stages of the Cosmos

This alternative world model put forward in Chapters 4.1 to 4.5 exhibits profound differences to the conventional doctrine of cosmology and the SMC in relation to:
- the initial stages of the cosmos,
- the boundary of the cosmos, and
- the end scenario of the cosmos

In order to avoid any misunderstandings regarding the initial stages of the cosmos, I shall recapitulate my above arguments at this point using a different choice of words:

At the world time $t = 0$, the first quantum of space (the "cosmic egg of creation"), is in a transient state of rest and begins—with the event known as the Big Bang—to suddenly expand from this transient state in an accelerated manner with both an unimaginably high quantity and density of energy. Here, it should be noted, the stabilising force of supergravitation did not take effect until later. In this model, there are no singularities associated with the initial state of the cosmos. This initial rapid expansion is combined with an equally rapid reduction in the energy density.

The accelerated expansion of the early cosmos lasts until the primordial photons have precisely reached a state of equilibrium between the two opposing forces acting on them (*i.e.* the primordial electromagnetism and the dynamic supergravitation) in accordance with the equation $G_{sup}/c_{sup}^2 = \text{const}$. at the speed of light

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[9]In his book "The Briefest History of Time", Stephen Hawking holds the view that the three dimensionality of cosmic space is an absolutely essential prerequisite for stable cosmic structures and the development of life!

"$c_{\text{sup}} \gg c$". This acceleration process is the **first transitional state of the primordial photons with variable (increasing acceleration) speed of light**.

The dynamic supergravitation is unable to establish a state of equilibrium with the electromagnetic force of the primordial photons until the value c_{sup} is reached. For this reason, the expansive radiation of the photons is the dominant force in the initial phase of the cosmos—the stabilising force of supergravitation does not (as yet) play any significant role at all. Once the value of c_{sup} has been reached, however, the two opposing forces are equal in strength, the resulting energy of the primordial photons is zero and the now constant speed of light c_{sup} possesses the highest value it is ever to achieve in the cosmos. It is, in fact, **this process of rapid expansion at the beginning of cosmic history that I consider to be the real "Big Bang" event**, and this has the same effect as that supposed to have been achieved by **"inflationary expansion"** according to the SMC. In contrast to this inflationary expansion postulated by the SMC, however, in my proposed model the mutual interaction between all the elementary particles remains preserved via c_{sup}. At no time do any areas of cosmic space exist completely devoid of energy. The accelerated expansion of the young cosmos is physically based on the electromagnetic force of the primordial photons. Due to the extremely rapid expansion, the extremely hot "primordial plasma" also undergoes a rapid cooling down.

Note: *According to the SMC, the "inflationary expansion" of cosmic space ensued during the "GUT" Epoch in the period from 10^{-35} to 10^{-32} seconds, by 3 to the power of 100—i.e. of the order of 3^{100}. This would mean that every 10^{-34} seconds, the diameter of the cosmos tripled in size, while in the course of this so-called inflationary phase the universe increased in size by a factor of 10^{50} and its volume by a factor of 10^{150}—the magnitude of both this factor and the aforementioned 3^{100} is such as to defy physical comprehension! In this process, the interaction between the individual elementary particles is broken and empty space, free of energy-fields, is created. Following this inflationary expansion, the elementary particles are supposed to "remember" the interaction they were involved in (cited from the book by Trinh Xuan-Thuan: "The Secret Melody", ISBN—440-06645-2).*

These "beautiful" parameters for "inflationary expansion" have been chosen to fit the purpose, being merely arbitrarily selected and having no basis in physics. Since various authors of literature on cosmology also make use of other "beautiful" parameters of their own choosing in describing inflationary expansion, it is therefore justified to cast doubt on this theory—such as it is. These or similar parameters are necessary for the sake of rescuing some of the inexplicable aspects of the SMC.

At the beginning of cosmic history, a state existed in the radiation-dominated epoch, in which there was one matter particle present for every approx. 10^{10} photons, in other words the cosmos was in effect a cosmos of pure radiation—matter being totally insignificant. Shortly afterwards, **within a period of between one second and 3 minutes, the transition consumed almost the entire cosmic energy of radiations within this short time span —leaving only a vanishingly small percentage as the "cosmic background radiation".**

This almost complete consumption of radiation energy that had initially by far dominated the cosmos is a sure sign that the accelerated expansion of the cosmic world mass must have ensued from a state of rest, and that the overwhelming majority of radiation energy was required both for the breaking of the incredibly strong gravitational coupling of the enormously dense world substrate (the Cosmic Egg) and for its rapid acceleration in the state of supergravitation.

This dramatic change in the state of cosmic energy shortly following the Big Bang has, however, received little attention to date, although it is of the utmost importance for the further development of the cosmos. Since the cosmic radiation energy (in common with all other forms of energy) cannot be annihilated but only converted by performing work, then incredibly powerful energy conversion products must have been created within this short interval in the young cosmic space.

One of these products is the energy-filled young cosmic space, rapidly growing with its accelerated world mass. The other product is the dark matter with the highest concentration ever existing in cosmic history– this is to be found at the boundary of the cosmos enveloping the latter and can be described as the gravitational "combustion residue" of the radiation energy consumed in the Big Bang and immediately afterwards.

The **"boundary of the cosmos"** thus reflects the incredibly rapid and high-energy events in the earliest stage of the cosmos, and lies forever beyond our **"cosmic horizon"**. For more information on this fascinating theme, please refer to paper [9].

The dark matter first created as a result of the extremely energetic events in the initial phase of the cosmos exhibits the highest energy concentration of dark matter ever to be found in the entire cosmic history; it envelops

the emerging cosmic space as an elastic cover, providing it with a strong gravitational boundary. The non-baryonic static gravitation of dark matter decoupled from the remaining world mass at an extremely early stage and since then has led its own independent existence. The only "external" effect it manifests is by means of its gravitational interaction with normal matter[10] (*refer to Chapters* 4.2.2 *and* 4.2.3).

5. Supplementary Remarks on the Early Period of the Cosmos

There exists a wide range of opinion on the **actual duration of the Big Bang** in specialist literature: some scholars maintain that the Big Bang was an energy impulse of incredibly short duration, while others believe that the Big Bang lasted until the photon radiation was unleashed (at a world time of up to 3 or 4×10^5 years). As no generally accepted opinion exists in this regard, I would propose that all the transient events occurring during the Planck Era (the duration of supergravitation) be combined together and incorporated into the expression "Big Bang". The validity of all the actual constants of physics and laws of nature then begins at the instant that the Big Bang phase is considered as ended.

Furthermore, all transition states specified during the state of the nascent cosmos represent **"cosmological phase transitions"**, resulting in fundamental changes to the physical characteristics of the early cosmos.

Apart from the transient events associated with the Big Bang, transition states of the photons (with variable speed) arise either as a result of a change in one or both field constants ε, μ (*refer to Chapter* 2), or by a change in the gravitational constant G—in accordance with the equation

$$G \big/ c^2 = G \cdot \varepsilon_0 \cdot \mu_0 = l_{\text{Planck}} \big/ m_{\text{Planck}} = G_{\text{sup}} \big/ c_{\text{sup}}^2 = 7.42 \times 10^{-28} \left[\text{m} \cdot \text{kg}^{-1} \right] = \text{const.} \quad [6] [7].$$

This equation reflects the fact that G/c^2 = const. is a united universal constant of nature, applicable both during the Planck Era [11] and for the entire duration of world time.

Due to the immense rapidity and dynamics of the events associated with the initial state of the cosmos, the primordial nucleosynthesis in this alternative model ensued in a similar way to that hitherto assumed in the SMC. During the process of nucleosynthesis, the protons and neutrons for the atomic nuclei of all the chemical elements were created, whereby the speed of these events were such that, to begin with, only the atomic nuclei of the light chemical elements could be formed.

Note: *According to the current state of knowledge, the primordial nucleosynthesis occurred at a world time from ca.* 1 *second to* 3 *minutes. After this time, the temperature and density of the universe had fallen below the critical levels necessary for nuclear fusion. During this epoch, it was therefore only possible for the nuclei of hydrogen* (75%) *and helium* (25%), *together with traces of deuterium and lithium, to be created, while all the heavy elements were only created at a later time as a result of processes occurring within stars.*

6. Summary

In the course of the transition of photons from one medium to another with differing field constants (ε, μ), there will be a short period, in which the photons travel with a variable speed (in either speeding up or slowing down) —*refer to Chapter* 2.

Cosmic expansion at world time $t = 0$ did not begin with an infinitely high temperature, energy density and speed of expansion—as assumed in the SMC—but with a rapidly accelerating expansion from an extremely dense world substrate at a state of rest (primeval cell of cosmic space) for a very short period. There were no singularities whatsoever associated with the creation of the cosmos (*refer to Chapter* 4.1).

It is this rapid expansion of the world substrate that represents the actual Big Bang and is the first energy effect of the primordial electromagnetic energy. Indeed, this is precisely the effect that the current doctrine in

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[10]In the current perspective of science, it is assumed that (static) gravitation decoupled from the primordial plasma at an extremely early stage (static gravitation being the only form of gravitation known to science). From this time, gravitation has supposedly existed as an "independent" force of nature with the constant value G. In fact, the overwhelmingly major part of gravitation, *i.e.* the non-baryonic static gravitation of the almost completely consumed primordial energy of radiation, decoupled from the other three forces of nature at an extremely early stage to lead an "independent life". In my opinion, the other gravitation (with the exception of the non-baryonic static gravitation of dark matter) is "not independent", because each and every amount and form of energy is inseparably associated with baryonic or non-baryonic dynamic gravitation (e.g. for photons). The expression "zero energy" has no validity anywhere in the entire cosmos, since—apart from anything else—the cosmic background radiation is present everywhere, this acting as the driving force for the expansion of the cosmos by continually providing a non-baryonic static gravitational field. For this reason, the entire cosmic space—without exception—is (and remains) always completely suffused by an—albeit extremely weak—gravitational field of dark matter.

cosmology describes as the "inflationary expansion" of the young cosmos (*refer to Chapter* 4.2.1).

The accelerated expansion of the young cosmos ensues in a state of "supergravitation" (G_{sup} as the Gravitational Constant) and lasts until a state of equilibrium is reached between the two opposing forces of nature (radiation and gravitation) with a speed of light $c_{sup} \gg c$. This accelerated expansion was the first transitional state of the primordial photons (*refer to Chapter* 4.2.1).

Following the acceleration stage, $c_{sup} = $ const. is the greatest speed of light ever achieved in the young cosmos during the Era of Supergravitation (*refer to Chapter* 4.2.1).

At the end of the Era of Supergravitation, G_{sup} is reduced to G (the gravitational constant known to us) in the course of a second transitional state, while c_{sup} is also reduced to c = const. during the same transitional state. From this time, the laws of physics known to us have applied (*refer to Chapter* 4.2.1).

Starting with the expansion phase of the world substance, one of the conversion product to be created from the exhausted cosmic radiation energy was dark matter (with the highest density ever to be found in the cosmos), which has since completely enveloped (and provided a boundary to) cosmic space. All the cosmic events that have subsequently occurred lie within this boundary (*refer to Chapter* 4.2.2).

The end of the expansion period of cosmic space is characterised by the total consumption of the electromagnetic energy driving the expansion. The expansion thus ceases, and—following a short period when the cosmos is at a state of rest—an implosion phase then begins. This corresponds to the model of an "oscillating cosmos" (*refer to Chapter* 4.2.3).

The dynamic gravitation internally associated with the electromagnetic radiation of the photons is quantised, and the gravitational constant G is implicitly included in the Maxwell Wave Equations [10]. It cannot therefore be excluded that the Maxwell Wave Equations also apply to the low-frequency gravitational waves of cosmic origin (*assuming that they indeed exist*, *which has not been established to date*), whose energy (in this case $E = h \cdot v$), however, would be so weak as to be undetectable—presumably not even with any future technology (*refer to Chapter* 4.3).

The transition from the radiation-dominated era to the matter-dominated era occurred at such an early stage (in the period from 1 second to 3 minutes) because practically all of the cosmic radiation energy (except for a miniscule remnant, *i.e.* the cosmic background radiation) was consumed in starting and accelerating the expansion of the world substance. This point is a particularly strong argument in favour of the cosmic expansion indeed ensuing from a world substance at a state of short-term rest (*refer to Chapter* 4.4).

As an energy effect, cosmic space is three-dimensionally structured and therefore—as with each and every energy effect—spatially limited (*refer to Chapter* 4.5).

7. Conclusions

1) According to the established doctrine in physics, the gravitation of photons is static in nature and is utterly insignificant in comparison to the electromagnetic force. In sharp contrast to this, I argue that **the gravitation of photons is, in fact, non-baryonic in nature and just as dynamic and as strong as the photons themselves.** Dynamic gravitation is indeed significant, since it determines the properties of the photons.

2) As far as dark matter is concerned, it has been assumed by the majority of cosmologists to consist of hitherto unknown heavy/massive particles, the search for which has begun this year with the enhanced-performance LHC. Contrary to this, I argue that **dark matter is, in fact, not massive at all** and originates from the non-baryonic gravitation of the photons consumed in the expansion of cosmic space.

3) By far the greater part of the originally existing cosmic radiation energy (with the exception of a miniscule residue—the cosmic background radiation) was used up in the Big Bang and directly afterwards in the (so-called inflationary) expansion of the young cosmos, being converted to non-baryonic, static gravitational energy in the process. This energy enveloped the freshly created cosmic space and represents the **gravitational boundary of the cosmos**. This gravitational boundary exerts an extremely strong gravitational attraction on cosmic structures in the vicinity—a phenomenon interpreted by physicists and cosmologists as an accelerated expansion of the remotely distant cosmic space, caused by the existence of a presumed "dark energy". In fact, however, I contend that what we are dealing with here is a **gravitational instability** based on an extremely strong gravitational field at the boundary of the cosmos acting on those cosmic structures that are located at the most remote distances from us. **Dark energy, as such, does not exist**.

4) There is no need to go hunting either for a new exotic form of energy or anti-gravity etc., because the na-

ture of the cosmos is not as complicated as has been hitherto assumed. It therefore also follows **that the same physical laws and forces apply at the boundary of the cosmos as they do in all its other parts!** These laws and forces were predetermined by the Big Bang and are eternally applicable everywhere in the cosmos.

5) In the event that this paper succeeds in helping to shed some light on the secrets of dark matter and dark energy, then a radically new picture would emerge of the early stages of the cosmos and its further development.

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