
IN SEARCH OF PARALLELS BETWEEN SCIENCE AND GENESIS 'HEAVEN' AS PHYSICAL VACUUM AND 'EARTH' AS VIRTUAL PARTICLES

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Abstract

It is shown that the words *Shamayim* ('Heaven') and *Erets* ('Earth') in the 1st verse of the *Book of Genesis* mean, correspondingly, the physical vacuum and the virtual particles. This correspondence is proved by the comparative analysis of the physical meaning of the words *Shamayim* and *Erets* (derived by means of the linguistic and exegetical analysis) with the meaning of the respective concepts of particle physics and cosmology, i.e. physical vacuum (quantum field in its ground state) and virtual particles.

Keywords: physical vacuum, virtual particles, *Shamayim*, *Erets*, quantum cosmology

1. Introduction

The origin of the world has been the point of interest for human kind since the dawn of the civilization. Since ancient times, every nation has had attempted to construct their own cosmological system (cosmogony). One of the most compelling cosmogonies (contained in the first book of the *Bible* - the *Book of Genesis*) was created by the Ancient Jews.

The *Book of Genesis* was written about 3000 years ago, therefore the literal meaning of its words cannot, in many passages (especially in its first chapter), convey the proper meaning of the message as currently accepted in modern science. Moreover, in order to make the text of *Genesis* more intelligible for the ordinary human being, the non-material was expressed in material terms. Moreover, some of the modern concepts about Universe plainly *did not exist* in those times. These are the reasons why *Genesis* uses simple words (such as 'earth' and 'heaven') loaded with the hidden physical meaning.

In this paper we conduct the linguistic and exegetical analysis of the two opening verses of the *Book of Genesis* (focusing on the words *Shamayim* 'Earth' and *Erets* 'Heaven') with the purpose to determine the scientific analogies to the religious concepts defined by the words 'earth' and 'heaven'.

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2. Results

2.1. 1st and 2nd verses from the original Hebrew text

In the original Hebrew text (Torah) the 1st and 2nd verses read: “*1 Bereshit bara’ Elohim et ha’shamayim ve et ha’erets. 2 Ve ha’erets hayetah tohuw va’vohuw ve’hoshek al-peneym tehom ve’ruach Elohim me’rahefet al-peneym ha’mayim.*”

We have employed several dictionaries as well as the commentaries of many biblical scholars in order to determine the self-consistent physical meanings of the words ‘heaven’ and ‘earth’.

The Meanings of *Shamayim, Erets, Tohuw* and *Vohuw*:

1. *Shamayim* (שמים) [< *Sham* (שם) “there; that which is away from us; a distant location” [1]] – 1) Heaven, the dwelling place of God [2]; 2) sky, the (seeming) celestial cover [2]; 3) the sky (perhaps alluding to the visible arch in which clouds move, as well as to higher ether where celestial bodies revolve) [3]
2. *Erets* (ארץ) [< *Ratsats* ‘to compress’ (according to Rabbi Ibn Caspi) [1, p. 37] or from ‘to be firm’ [3]] – 1) ground 2) land, territory, country; 3) the whole of the land, the earth [2, 4]; 4) dust [4]; 5) primary matter [biblical scholars]
3. *Tohuw* (תהו) [< ‘to lie waste’] – 1) emptiness (= unreality) [2]; 2) a desolation; *figuratively* a worthless thing [3]; 3) waterless and impassible desert [2]
4. *Vohuw* (בהו) [< ‘to be empty’] – emptiness, wasteness [2]; vacuity [3]

2.2. *Shamayim – Heaven – invisible space*

The 19th-century Russian Orthodox Saint and Metropolitan of Moscow Filaret Drozdov, following the Church Fathers (Theophilus of Antioch, Basil the Great, Theodorite, John of Damascus, etc.) says that *the Heaven and the Earth* are the consequence of the creating force of God [5]. These names, used together, usually mean the entire work of creation. Saint Filaret Drozdov emphasizes that the word ‘heaven’ (*Shamayim*) in the 1st verse is “neither Earth’s sky nor star sky, for the firmament was created on the second day” [5]. He explains that we can understand it as *the heaven of the heavens* or the *invisible* (spiritual) world [5] (compare to Colossians 1.16, “For by him all things were created, visible and invisible”). Actually, both, Old and New Testament, teach about the spiritual world as *existing in reality* (Genesis 3.24, Genesis 28.12, Genesis 32.1-2, Job 38.7, etc.).

The profound development of the biblical idea of ‘heaven’ as the invisible spiritual world is conducted by the Orthodox Saint of the 4th century, Augustine of Hippo, in his *De Genesi ad Litteram (On the Genesis Literally)*. He starts by calling *heaven* ‘life of the spirit’ (contrary to *earth* being bodily matter – ‘the material world’) [6]. Then he suggests that the heaven was *perfect from the very*

beginning: “by the expression ‘heaven’ we must understand a spiritual created work already formed and perfected” [6, p. 27].

Saint Augustine’s idea about heaven’s perfection resembles the time-invariance of the cosmic vacuum permeating the entire space (see more details below). Finally, Saint Augustine explicitly talks about the *immateriality* of *heaven*: “[heaven] means not the material heaven but the immaterial heaven above it,” [6, p. 38], then explaining it: “the heaven is exalted above every material thing not by its [spatial] location, but by the excellence [elevatedness] of its nature” [6, p. 38].

Thus, following Saint Filaret and Saint Augustine, we may interpret *heaven* of the 1st verse as ‘*non-material invisible world (space)*’.

Just as we saw it with Christian theologians, the 20th century Jewish scholar, Rabbi Eli Munk, states that *Ha’Shamayim* in the 1st verse is not identical with *Shamayim* of the 8th verse (translated there as ‘sky’), explaining it in the following way: “*Shamayim* of the 1st verse must be something ‘outside’ our Cosmos, which is not described, as it is not accessible to our experience” [1, p. 57].

He also cites Rabbi Vilna Gaon who tells us that the word *Shamayim* etymologically derives from *Sham*, “a distant location” [1, p. 57], while Rabbi Eli Munk himself adds another meaning: “there; that which is away from us” [1, p. 41]. Thus, according to Jewish Rabbis, *Shamayim* in the 1st verse refers to ‘*imperceptible, invisible space*’ which is ‘*away from us*’.

Now, based on etymological and exegetical analysis of the 1st verse, conducted by both, Christian and Jewish scholars, we conclude that the word *Shamayim* (‘*heaven*’) in the 1st verse means ‘*non-material and invisible (imperceptible) space*’.

2.3. *Erets* – *Earth* – *imperceptible matter*

The translation of the word *Erets* (אֶרֶץ) in every English version of the *Bible* – ‘*the earth*’ - infers that it literally means ‘the planet Earth’. However, we cannot accept the literal meaning of *Erets* as its proper physical meaning, as will be shown by the exegetical analysis of the 1st verse of *Genesis*.

First of all, if you read the 1st verse in Hebrew, you will see that the word *Erets* has a definite article *Ha* in front of it. The 18th century Jewish Rabbi Vilna Gaon explains the difference in the forms *Erets* and *Ha’Erets*: *Ha’Erets* means ‘*all existing states of the material world*’, while *Erets* (without the definite article *Ha*) is used only to indicate ‘dust’ [1, p. 41].

Saint Filaret, the Metropolitan of Moscow, explicitly states in his *Commentaries* that the word *Erets* (‘the earth’) in the 1st verse “does not mean the Earth globe” [5, p. 30]. Then he explains the true meaning of the word *Erets* (as used in the first two verses of *Genesis*), saying that it is the name for *the matter of this Universe in general* [5, p. 30], and that “it means primary matter, and [serves] like the seeds for the visible world” [5, p. 27].

Saint Augustine in his *Genesi ad Litteram* supports the idea of ‘the earth’ being ‘primary matter’ or, more precisely, ‘pre-matter’, by stating that it was an *unformed imperfect substance [matter]*, out of which all other (temporal) things would be made [6, p. 27]. Then he expands this idea: “It (the heaven and the earth) was the substratum of what was to be made, although it did not exist before it was created” [6, p. 154].

The 4th century Orthodox Saint and Enlightener of the Church, Basil the Great, also supports the idea that ‘the earth’ means ‘pre-matter’ (in the sense of ‘something potential out of which everything actual will evolve’) by stating in his *Hexaemeron* that “everything was created at a single moment of creation, because everything is contained in everything: in earth you will find water, air and fire; therefore do not search for a mention of every element, but know that the said implies unsaid” [7].

Thus, as all the commentaries suggest, *Erets* in the 1st verse cannot mean ‘the planet Earth’, but it refers to *unformed imperfect substance serving as an invisible substratum (seeds) for everything in our Universe*, or in short, ‘non-material pre-matter’, meaning ‘substanceless entity out of which the actual primary matter evolves’. Let us refine this meaning by looking at the commentaries on the word *Erets* as used in the 2nd verse.

The word *Erets* in the 2nd verse of Hebrew text has two extremely important qualifiers: *Tohuw* and *Vohuw*. These words are translated in KJV as ‘without form and void’, in NIV as ‘formless and empty’ and in NSRV as ‘a formless and void’. It is noteworthy that the words *Tohuw* and *Vohuw* essentially mean the same: *Tohuw* means ‘emptiness, unreality’, and *Vohuw* means ‘emptiness, vacuity’.

The well-known 13th century Jewish Rabbi Nachmanides in his *Commentary on Torah* mentions that the word *Tohuw* is the Hebrew analogy to the Greek word *hyly (matter)*. He explains the origin of the word *Tohuw* by deriving it from the expression *Betohei* meaning “bethinking oneself of one’s doings in the past” [8]. Nachmanides makes a conclusion that *Erets* (‘the earth’ – ‘non-material pre-matter’) after the initial moment of creation was in the state of *Tohuw*, that is, ‘matter without substance’ [8, p. 25]. A 19th century Russian Orthodox Archbishop Innokentiy lends a support to Nachmanides by saying that ‘formless and void earth’ implies the *non-existence* [of matter] (in Ancient Greek *ouk onton*) in the sense of *matter without substance* [9].

Saint Filaret Drozdov in his *Commentaries* states that the *initial matter* (“earth”) is described in *Septuagint* by the words *ahorato* and *hakataskeuastos*, which means ‘invisible and unfurnished (unconstructed)’ (which corresponds to ‘formless and void’). He explains that these words describe matter which *does not possess the forms* that we associate with the created things [5, p. 31]. Saint Augustine ‘extends’ Saint Filaret’s explanation by saying that the *formed* matter implies the existence of forms that “are perceptible by the sight and other senses” [6]. From this statement we make a conclusion that the formless pre-matter (‘the formless earth’) was *imperceptible*, i.e., “lacking all the body qualities that appear in formed matter” in Saint Augustine’s words [6].

Thus, based on the commentaries of biblical scholars, we conclude that the words ‘earth was formless and void’ mean “*the imperceptible matter in the state of potentiality (in the state of actual non-existence)*”, i.e., ‘*pre-matter without substance*’. This confirms the physical meaning of the word *Erets* in the 1st verse discussed above – ‘*non-material pre-matter*’ (‘non-material’ in the sense of lacking substance),

Nachmanides in his *Commentary on Torah* explicitly states that *Erets* in the 1st verse of the *Book of Genesis* means ‘*non-material pre-matter*’ (*substance devoid of corporeality* in his terms): “Instead He [God] brought forth [...] a substance devoid of corporeality [meaning that it was non-material, devoid of matter in its proper sense.] but having a power of potency, fit to assume form and to proceed from potentiality into reality. This was the primary matter created by G-d; it is called by the Greeks *hyly* (matter). After the *hyly* He did not create anything, but He formed and made things with it, and from this *hyly* He brought everything into existence and clothed the forms and put them into a finished condition. Know that heavens and all that is in them consist of one substance, and the earth and everything that is in it consist of one substance. The Holy One, blessed be He, created these two substances from nothing; they alone were created, and everything else was constructed from them.” [8, p. 23]

Finally, the contemporary of Saint Basil the Great (and his brother), the Orthodox Saint and Enlightener Gregory of Nyssa gives the most profound explanation for the *non-material pre-matter* (‘*the earth*’) according to which it is the set of uncombined imperceptible qualities:

Согласно Григорию Нисскому, невещественная праматерия представляет собой *сверхчувственные (невещественные) силы/качества/концепции* (которые находятся за пределами нашего восприятия). Он особо подчеркивает, что вещество в этой первичной невещественной праматерии существовало только *в возможности* (а не в действительности): “[...] everything was already in the possibility [*potential*], [...] but in reality [actuality] there was no separate thing. Earth both, existed and did not exist, because the qualities did not unite in it.” [Saint Gregory of Nyssa, *On Hexameron*, col. 77D, col. 80A]

In this statement he accentuates the *potential* character of the original pre-matter: the substance did not exist in actuality in the initial state of ‘the earth’.

Saint Gregory of Nyssa defines a *concept/quality* as ‘*something imaginable in mind, but not bodily*’. Then he makes a conclusion about ‘the heaven and the earth’ as the imaginable forces out of which the real matter would later evolve: “... the mutual unification of these [imaginable] forces brings forth the corporeal entity [matter]” [10].

Essentially, Saint Gregory of Nyssa confirms that “the heaven and the earth” in the 1st verse collectively mean the *non-material foundations of the Universe*, which echoes Saint Augustine’s concept of ‘the heaven and the earth’ being ‘substratum of what was to be made’. Gregory of Nyssa explicitly supports the idea of ‘the heaven and the earth’ being ‘everything created’ by

saying that “the heaven and the earth mean everything contained inside these limits” [10, p. 11].

Thus, based on the exegetical analysis of the 1st and 2nd verses, we derive the physical meaning of the word *Erets* (earth) in these first two verses: ‘*the substanceless pre-matter existing only in potentiality*’, i.e. ‘*something imperceptible and without substance, out of which actual matter will evolve*’. This meaning establishes one of the direct connections between the *Book of Genesis* and the currently accepted scientific theory of the Universe’s origin – *Λ-CDM cosmology*, also known as the Big Bang Theory.

3. Discussion: correspondence of *Shamayim* and *Erets* to the physical vacuum with virtual particles

We are ready to compare the biblical ‘*the heaven and the earth*’ – the initial invisible entities created by God - with their scientific counterparts – the physical vacuum and the virtual particles contained in it. We will find the equivalence between biblical ‘heaven’ and *physical vacuum* as well as between ‘the earth’ and the *virtual particles* contained in this physical vacuum.

3.1. The origin of the Universe according to the Theory of quantum birth

The integral part of the Big Bang Theory – the theory of quantum birth of the Universe - states that matter, space and time were created almost at a single instance in a very distant past (13.7 billion years ago), possibly from a *non-physical* quantum field. This field did not exist in classical sense, i.e., it possessed no substance and no space. It was not a physical reality, but just a *mathematical construct*, called by Alexander Vilenkin (the originator of the quantum birth theory) ‘*literal nothingness*’ and by Alan Guth (one of the fathers of inflationary theory) ‘*absolute nothingness*’. ‘Prior’ to a spontaneous fluctuation (see below) of this mathematical field no matter, space and time (i.e., our physical reality we call ‘Universe’) existed. Compare this description to a statement by the 12th century Jewish sage Maimonides: “prior to the creation of Universe space did not exist” and “time is one of the *created* accidents” [11].

Due to a spontaneous fluctuation in the ‘original’ non-physical quantum field, the virtually existing particle representing our future Universe underwent a quantum tunneling process through the potential barrier separating the purely mathematical ‘realm’ of ‘quantum nothingness’ from the physical reality, and became the really-existing Universe in the form of *physical* quantum field occupying a tiny volume of space (so called Planck’s volume). Note the difference between *non-physical (pseudo-real)* and *physical (real)* quantum fields: the former is *not physically real* and has no properties of physical reality associated with it, while the latter *exists in reality*.

The physical quantum field appeared in its metastable state (false vacuum state) and contained no ordinary matter, but only *virtual* particles. True vacuum state is the absolutely lowest energy state of quantum field, therefore ‘false’ implies that the newly-born quantum field was not in the lowest energy state.

The material substance as we perceive it (matter in the form of material particles – electrons, protons, etc.) did not exist right after the birth of the Universe. Only a fraction of a second later the real material particles were born from the virtual particles.

3.2. *Shamayim* as *physical vacuum*

Let us investigate the possible analogy between biblical heaven and *the primary quantum field* which represented the newly-born Universe. The physical properties of *Shamayim* (the heaven) - *the invisible non-material space* – closely match the properties of the primary quantum field (or, more exactly, of the *physical vacuum* - quantum field in its lowest energy state). Indeed, the medium called ‘physical vacuum’ possesses the following essential properties [12]:

1. It exists in the Universe since its beginning;
2. It is immutable (its energy density remains constant as the Universe expands);
3. It contains no material particle or material field and, therefore, imperceptible;
3. It fills the space uniformly at all observable scale levels of space – up to a fraction of a micrometer. An object immersed in this medium does not displace it from the volume that it occupies.

Now, compare this *scientific* definition of physical vacuum to the Judeo-Christian idea of *heaven* as *absolutely perfect entity* (in the sense of immutability), elevated above everything else (i.e. absolutely different in nature). This is explicitly expressed by Saint Augustine: “by the expression ‘heaven’ we must understand a spiritual created work already formed and perfected” [6, p. 27] and “the heaven is exalted above every material thing not by its [spatial] location, but by the excellence of its nature” [6, p. 38].

Thus, *Shamayim* may be equated with the immutable *physical vacuum* (quantum field in its lowest energy state – vacuum state), and, therefore, with Einstein-Gliner cosmic vacuum represented by Einstein’s cosmological constant Λ , and even with dark energy [12].

3.3. *Erets* as *virtual particles*

The word *Erets* (the earth) whose physical meaning is ‘*the non-material pre-matter existing in potentiality*’ obviously refers to *virtual (unobservable) particles* which existed only *in potentia* (potentially) in the physical quantum field at the moment of its birth. According to the Big Bang Theory no real material particles existed initially. Only a fraction of a second after the beginning the imperceptible virtual particles evolved into observable elementary

particles of real matter. Recall that Saint Augustine calls ‘the earth’ (*Erets*) ‘the imperfect matter’, and Jewish Rabbi Nachmanides calls it “substance devoid of corporeality fit to assume form and to proceed from potentiality into reality”.

4. Conclusions

Based on the comparative analysis of the first two verses of the *Book of Genesis* with the *Λ -CDM cosmology*, we were able to show the following equivalences:

Shamayim (the heaven) = initial quantum field which came into existence 13.7 billion years ago and then immediately transited into its lowest energy state, i.e., *physical vacuum*.

Erets (the earth) = *virtual (unobservable) particles* which existed only in potentia (potentially) in the initial quantum field at the first moments of its existence.

Thus, the final conclusion is: *Nature (and physics describing it), being the natural revelation from God about the origin of the Universe, converges with Christianity (and metaphysics) as a supernatural revelation about the same event.*

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