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# HOW DID THE UNIVERSE ORIGINATE

## THE ABSOLUTE BEGINNING VS. ETERNAL MATTER

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### Abstract

The paper reveals the essence of materialistic and Christian beliefs with respect to the origin of the world. The Christian dogma of the world's creation by God is compared against the materialistic hypotheses of the uncaused origin of the world (including Stephen Hawking's proposal of M-Theory as an Ultimate Cause). Finally, the implications of singularity theorem for understanding the origin of the Universe are presented.

*Keywords:* M-Theory, Universe, creatio ex nihilo, eternal matter, Epicurus

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### 1. Introduction

The question 'How did the world come to being?' vexes humans from the very dawn of civilization. Did the world have a beginning or is it beginningless (i.e. it exists forever)? If the world had a beginning, what is the source from which it came? And how did this source itself originate? Finally, did the world *originate by itself or did it have a cause?*

Definitive answers to these questions are not yet found (except for the conditional answer to the question of the beginning of time, given by the singularity theorem [1]). However, people for some unknown reason, choose a particular answer, and *believe* that this answer is true. For example, Christians believe that the world (*including the primary matter from which it was created*) had a beginning, and *this beginning was laid by God Who acted as the cause for the world*; materialists, on the other hand, believe that *something material (sometimes calling it 'nothing', but always implying 'something') existed forever, and that our Universe appeared spontaneously (by chance/without a cause) out of this eternally existing something.*

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## 2. Discussion

### 2.1. *The struggle between Christianity and materialism*

There is a permanent struggle between materialistic and Christian points of view on the origin. Recently this struggle has experienced a surge: several books written by materialistic scientists were published. These books, including ‘*The Grand Design*’ (2010) by British cosmologist Stephen Hawking and ‘*A Universe from Nothing*’ (2012) by American astrophysicist Lawrence Krauss, criticize the Christian idea of the Universe’s origin, recorded in the opening verses of the first book of the *Bible* – *The Book of Genesis*. The principal ideas of theism criticized by Stephen Hawking and Lawrence Krauss remain the same as in the old days of the ancient materialists: *the idea of God’s existence* and the idea inextricably linked to it – *the idea of the createdness of the world by God* (the ‘*creatio ex nihilo*’ dogma).

### 2.2. *The matter and materialism*

In the discussion of the origin of the world (which is primarily *material*), it is necessary to define the concept of matter. The term *matter* (< Latin *materia*, ‘substance’) refers to all *physical* objects in the Universe, as *opposed to non-physical (spiritual)*. All matter in the Universe is divided into the following main types: *substance, fields, the physical vacuum, and objects of unknown physical nature* (dark energy and dark matter). A substance mainly consists of the following ‘building blocks’: electrons (elementary particle of matter), protons and neutrons (we intentionally limit the number of ‘building blocks’ in order to avoid the unnecessary complications). At the beginning of the Universe electrons, protons and neutrons were free, but now they are bound together in particles called ‘atoms’. Classical fields include electromagnetic and gravitational fields. The physical vacuum is not just a void, as one may refer from its name, but contains a certain amount of energy [2]. In fact, the physical vacuum is a form of matter devoid of real particles of substance as well as of electromagnetic fields. It is considered by physicists to be *the most fundamental form of matter*, similar to the *substanceless pra-matter (ether) of ancient philosophical doctrines* [3].

Having the matter defined, let us deal with the essence of materialism. Materialism at its core is a philosophical belief tracing back to Ancient Greece (see Section 2.4) [4]. The main principles of pure materialism are: 1) *nothing exists except matter* (neither God, nor the spiritual world of the angels, not even the human soul), and 2) *the world originated by itself* (following the physical laws).

### **2.3. The origin according to ancient materialism**

Let us examine the roots of materialistic beliefs on the origin of the world. Ages ago the ancient Greeks tried to find the primary reality as well as God Himself in the created (material) world surrounding them. This worship of matter (nature) led some Greek philosophers to the formulation of *ancient materialism*, which completely discarded the existence of spiritual, non-corporeal, immaterial entities.

#### *2.3.1. Democritus*

According to some ancient sources, the Greek philosopher Leucippus is considered to be the father of ancient materialism. However due to a lack of reliable information about him, the first doctrine of materialism is associated with the student of Leucippus - Democritus (460-370 years B.C.). He was trying to find the purely natural (material) causes for all phenomena. Democritus adhered to the principle of conservation of the being ('nothing comes from nothing', Latin '*ex nihilo nihil fit*') formulated in 5<sup>th</sup> century B.C. by the Greek philosophers Parmenides and Melissus of Samos. According to the metaphysics of Democritus, the world is an emptiness in which myriads of atoms rush *aimlessly*; mixing, they completely *spontaneously* form bodies (this idea of *spontaneity* will become the starting point for the cosmogony of Democritus' follower - Epicurus).

Democritus believed that *chance is the lord and king of the Universe*, and *Destiny (Fatum) is the Power creating the world*. Thus, the ancient materialism basically represented the *ancient belief in Fatum*.

#### *2.3.2. Epicurus*

Epicurus (341 - 271 years B.C.) succeeded Democritus as the leader of the ancient Greek materialism (he acquainted himself with the teachings of Democritus in his early adolescence). One can understand the doctrine of Epicurus only taking into account the fears, which possessed a philosopher in the early years of his life: the fear of death and the fear of the unknown. Epicurus found the exemption from his fears in the teachings of Democritus. He did not become a member of the school of atomists-materialists, but he learned the *metaphysics of materialism*: being a materialist, *Epicurus did not believe in anything purely spiritual* (following Democritus, Epicurus thought that even *the gods are material*).

According to the Epicurean metaphysics, a multitude of worlds in the Universe is being eternally born (from clusters of atoms) and being destroyed, moreover this process occurs *spontaneously* and *without the intervention of any higher powers (God)*: "Moreover, the sum total of things *was always such as it is now, and such it will ever remain*. For **there is nothing into which it can change**. For outside the sum of things there is nothing which could enter into it

and bring about the change [here Epicurus denies the existence of omnipotent God]. [...] Of all this [by 'this' Epicurus means atoms and void] there is no beginning, since both atoms and void exist from everlasting." [D. Laertius, *Lives of Eminent Philosophers*, Book X, cc. 39, 44]

Epicurus has also proposed a materialistic principle of *self-organization of matter*: "That there is an infinite number of such worlds can be perceived, and that such a world may arise in a world or in one of the intermundia (by which term we mean the spaces between worlds) in a tolerably empty space and not, as some maintain, in a vast space perfectly clear and void. It arises when certain suitable seeds rush in from a single world or intermundium, or from several, and undergo gradual additions or articulations or changes of place, it may be, and waterings from appropriate sources, until they are matured and firmly settled in so far as the foundations laid can receive them." [D. Laertius, *Lives of Eminent Philosophers*, Book X, cc. 89, 90]

These ideas of Epicurus (about the eternal existence of matter and the spontaneous birth of a multitude of worlds) have been recently reanimated by modern materialists, as discussed in Sec. 6.

#### 2.4. The origin according to Christianity

The Christian belief in the creation of the world by God (the *creatio ex nihilo* dogma) is founded on an Old Testament idea of 'creation out of nothing' ('*creatio ex nihilo*, in Latin), present in the first verse of the *Book of Genesis* (Genesis 1.1). It is encrypted by means of the Hebrew word **בָּרָא** [Bara] (translated into English by the word 'created') [3].

A first Christian work which clearly reveals the idea of 'creation out of nothing' is *Shepherd of Hermas* (late 1<sup>st</sup>-early 2<sup>nd</sup> century BC), where we find the following statement rooted in the Old Testament (namely in 2 Maccabees 7.28), which speaks of God bringing the world out of non-being (*εξ τοῦ μὴ ὄντος*) into being: "First of all, believe that God is one, even He who created and ordered all things from non-existence [from non-being, *εξ τοῦ μὴ ὄντος*, *ex nihilo*]." [5] As we see, in the Latin translation of the *Shepherd* made in the middle of the 2<sup>nd</sup> century BC, the Greek term *μὴ ὄντος*, 'non-being' is translated with the word *nihil*, 'nothing', which gave the Latin name to the dogma of 'creation out of nothing' - *creatio ex nihilo*.

It took some struggle against non-Christians (mainly against the followers of Greek philosopher Plato) and Christian Gnostic heretics, before the explicit expression of the *creatio ex nihilo* dogma was formulated in its orthodox form by the Christian theologians circa 180s A.D. According to Plato, *matter and God-the-Demiurge are co-eternal*, i.e. God of Plato is not the Creator, He *does not create matter*, but simply shapes it just as a craftsman makes things out of the *already available* material. Cosmos is created by the God-the-Demiurge by transforming the eternal matter (the disorderly elements) into visible things of the Universe by means of giving it various shapes. Indeed, the idea of 'creation out of nothing' was alien to all philosophical schools and cosmological systems

of the Greco-Roman world, including Plato's doctrine of the eternal coexistence of matter and God, Epicurean doctrine of eternal and spontaneous generation of worlds and pantheistic doctrine of the world as part of God.

The dogma of *creatio ex nihilo* in the orthodox (purified from Gnostic views) Christian tradition took its final wording circa 160 -180s BC in the writings of Justin the Martyr, Tatian of Assyria, Saint Theophilus of Antioch and Saint Irenaeus of Lyon, the last of which put a final touch on it: "*For He [God] is Himself uncreated, both without beginning and end, and lacking nothing. He is Himself sufficient for this very thing, existence; but the things which have been made by Him have received a beginning...*" [Saint Irenaeus, *Against Heresies*, 3.10.3]

Here is the modern formulation of *creatio ex nihilo* dogma: "... *as the Revelation teaches, the world was created by almighty and wise God, and created both in its form and in substance. God created it not from anything prepared [not from pre-existing matter] or out of His own substance; but created it solely through the act of His almighty will, by bringing His thoughts about the world into being, and did not lose anything of Himself because of it...*" [6]

Since the end of the 2<sup>nd</sup> century AD, this dogma has become one of the fundamental truths of the Christian Church. Indeed, for Hippolytus, Tertullian, Origen, and Athanasius (3<sup>rd</sup>-4<sup>th</sup> century AD) the creation of matter from nothing is the approved and unquestionable truth.

### **3. The origin according to Stephen Hawking and Lawrence Krauss**

Let us investigate the recent revival of materialistic beliefs on the origin of the world by the American astrophysicist Lawrence Krauss and British cosmologist Stephen Hawking. First of all, in his book, '*A Universe from Nothing*', Dr. Krauss denies the creation of the world by God (the *creatio ex nihilo* dogma), and the very existence of God: "... *even a seemingly omnipotent God would have no freedom in the creation of our universe. No doubt because it further suggests that God is unnecessary - or at best redundant.*" [7]

Then Dr. Krauss (obviously acquainted with the works of Epicurus) invokes two versions of the uncaused origin of the Universe, in both of which Dr. Krauss puts *spontaneity* as a primeval mover. In the first of these materialistic scenarios the Universe is spontaneously created from nothing: "... *one can imagine one specific type of universe that might spontaneously appear and need not disappear almost immediately... [...] a universe could and plausibly did arise from a deeper nothing - involving the absence of space itself.*" [7, p. 165, 183]

In the second scenario, Lawrence Krauss eliminates God-the-Creator in favour of the set of parallel and eternally existing universes - a multiverse (recall the idea of Epicurus about eternal multitude of worlds): "*Our modern understanding of the universe provides another plausible and, I [Lawrence*

*Krauss] would argue, far more physical solution to this problem [that of the origin of the world] ... I refer here to the multiverse.” [7, p. 175]*

In 2010 bestseller ‘The Grand Design’ Stephen Hawking invokes the same ancient materialistic ideas of spontaneous generation and (eternal) existence of multiple worlds: “According to *M*-theory, ours is not the only universe. Instead, *M*-theory predicts that a great many universes were created out of nothing. Their creation does not require the intervention of some supernatural being or god. Rather, these multiple universes arise naturally from physical law. [...] Spontaneous creation [of the Universe] is the reason there is something rather than nothing, why the universe exists, why we exist. It is not necessary to invoke God to light the blue touch paper and set the universe going.” [8]

Note that Dr. Hawking founds his *belief* in uncaused emergence of the world *not on the fact but on a theory* (M-theory) which is *unconfirmed*. M-theory is a fancy term for the multi-dimensional superstring theory (is an extension of string theory in which 11 dimensions of spacetime continuum are identified as 7 higher-dimensions plus the 4 common dimensions). Indeed, the renowned British mathematical physicist and cosmologist Roger Penrose points out that “*unlike quantum mechanics, M-theory enjoys no observational support whatsoever*” [R. Penrose, *Review of The Grand Design*, FT Magazine, 4 September 2010, <http://www.ft.com/intl/cms/s/2/bdf3ae28-b6e9-11df-b3dd-00144feabdc0.html#axzz3UvvWnpHg>]. The main argument against Hawking’s reasoning is based on the fact that *the theory and the laws by themselves cannot create anything* [9]. Thinking that the laws can produce something on their own is equivalent to the assumption that the summation by itself (as a mathematical operation) will result in additional money in your bank account [10].

#### **4. Conclusions - absolute beginning vs. eternal matter**

It has been shown that the question of the world’s origin remains in the realm of philosophical/theological beliefs. Now, which belief is closer to the truth: belief in the absolute beginning of the Universe (possibly initiated by God) or belief in eternal matter and spontaneously generating worlds? Let us look at the indirect arguments available from modern science.

On one hand, the metaphysical belief in eternal matter (and a multitude of worlds spontaneously arising from it) remains scientifically unproven. On another hand, the 2003’s singularity theorem by Borde-Guth-Vilenkin [1] *mathematically* proves the existence of the beginning of time (‘before’ which the time did not exist at all), essentially refuting the eternal existence of matter. This theorem puts a lower temporal limit on the existence of physical reality, thus scientifically proving that matter originated some *finite* time ago. In more technical terms, the Borde-Guth-Vilenkin singularity theorem tells that the space-time continuum of the inflationary Universe does not extend infinitely into the past, i.e., the Universe *is not eternal* as you travel back in time, but it has a low bound - a moment of beginning (or a finite interval of time during which the

Universe has been originated). Technically, the proof is based on kinematics considerations of the relative motion of two observers (spectators), by following them back into time. These imaginary observers are considered to be moving through the Universe under the action of gravity. The observers see each other moving farther away from each other, because the Universe is expanding. Another observer (space traveler) is moving relative to the spectators. He moves by inertia only, hypothetically (if time has no beginning), for infinite amount of time. However, it was shown that the time measured by the space traveler's clock is *finite*. Thus, the Borde-Guth-Vilenkin singularity theorem shows that under the assumption of the positiveness of the average expansion rate of the Universe in the past (i.e., when the averaged Hubble parameter,  $H_{av}$ , is greater than zero), any backward-going interval connecting two points in spacetime continuum *must have a finite time-like length*, or, in simple terms, if you follow any sequence of events in the Universe back in time, you will find it to be finite.

Thus, the singularity theorem implies the existence of absolute beginning of the Universe with its obvious implications for the existence of cause of this beginning.

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