

Tagma (order) Ermeas Trismegistos

Science advances the Mysteries

Panos Mavitzis^α, Yorgos Kelmayer^β

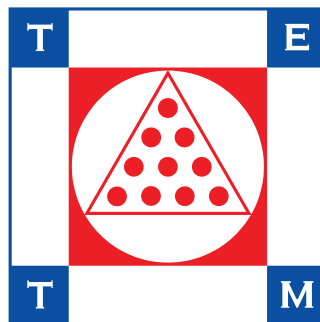
^αProtodidaskalos of Tagma (order) Ermeas Trismegistos, psychotherapist-supervisor, ex vice president of the greek branch of the European Association of Psychotherapy, ex vice president of the greek branch of the European Association of Body Psychotherapy

^βMathematician, BSc, MSc in differential geometry

Official webpage: www.erneastrismegistos.com/

E-mail: trismegistos@ath.forthnet.gr

Abstract. Mystery rites need to advance and evolve, as science is demonstrably evolving, since the Mysteries are not dogmatic situations that put people on trial, as was the case with Galileo Galilei, who would have been convicted for daring to assert the obvious: that Earth is a planet revolving around the star Sun (he renounced his claim to save himself, but in the end he exclaimed “E pur si muove - And yet it moves”). Moreover, Plato, in his allegory of the cave, taught that men, chained in the depths of a cave, see only the shadows of the fictitious reality projected on the wall by a fire which burns behind them. Trapped inside the cave, people do not perceive the brilliance of the Sun and the splendor of Nature. The Tagma (order) Ermeas Trismegistos accepts anything that can evolve and strengthen its mystery rites. The purpose of this paper is to give the current picture of the Order’s esoteric course, which is based both on the modern scientific view of the cosmos, and on the esoteric Pythagorean philosophy.



Contents

Introduction	2
Cosmogenesis	3
Standard cosmological model	3
Primordial vacuum	3
Planck epoch	3
Cosmic inflation	3
Big Bang	4
Grand unification epoch	4
Electroweak epoch	4
Quark epoch	5
Later epochs	5
New physics	7
Informational cosmology	7
Ekpyrotic universe	7
Ananke (Necessity)	8
Pythagorean philosophy	8
Mēdén (not monad/not one)	9
Monad	9
Dyad	9
Quintessence	10
Triad	11
Between the Dyad and the Triad	11
Tetrad	11
Appendix of scientific terms	13

Introduction

The Mysteries, both of the Tagma (order) Ermeas TrisMegistos and of most esoteric organizations, imitate Cosmogenesis, in order to manifest the proper conditions for the creation of the spiritual person. Therefore, initially, a brief summary of the creation of the universe based on modern cosmology will be provided, setting forth the scientific foundation and footing of the theurgic rituals of the Tagma Ermeas TrisMegistos.

Some of the initial stages of the evolution of the universe are still at a theoretical level and the theories that try to describe them are based on arbitrary assumptions, without any experimental proof. They are, in other words, theory-conjectures and therefore the reader is invited to understand the broader concepts and not to get stuck on the explicit meaning of the terms.

All scientific data in this paper have been taken from scientific sources and are in no way the intellectual property of the authors. As such, sources for the scientific positions of the paper will not be cited. Further information on the theses that follow can be found in a multitude of scientific papers, which are even freely available on the internet.

Cosmogenesis

The creation of the universe took place in different epochs (periods). The reader can follow the development of the epochs schematically in *diagram 1*, which is given below. The reader can also find a brief explanation of the terms used in the *appendix* at the end of the paper.

Each period has its own characteristics, but there are certain constants that run through all the epochs of the universe. These are:

1. *Spacetime* is expanding at an accelerating rate. The acceleration is not always constant.
2. The *average temperature* of the universe decreases as spacetime expands. Equivalently, the *energy* of each particle decreases accordingly.
3. The *drop in temperature/energy* disturbs the equilibrium of the system in a given period, causing the system to *collapse* to a different equilibrium level, with lower energy and temperature, where the system is more stable.
4. The *entropy* of the universe is constantly increasing until it reaches a final maximum value. Thus, the universe will reach *thermodynamic equilibrium* (heat death of the universe/vacuum state).

Standard cosmological model

If in the standard models of general relativity and quantum field theory time is reversed, then the standard cosmological model emerges. It is the most widely accepted cosmological model by the scientific community, but it presents many unsolved problems.

Primordial vacuum

The standard model states that at the beginning there is a false vacuum state, where the energy of the *primordial vacuum* is not the most stable and the least possible. The primordial vacuum is *metastable*. Suddenly, a point of the false vacuum collapses into a more stable state with lower energy. This transition spreads like a wave throughout the vacuum, causing it to reach equilibrium at this new (false) vacuum state, with the energy at a local minimum[‡].

Planck epoch

(from $t=0$ to $t=10^{-43}$ seconds)

From the *energy* released during the vacuum collapse, a *spacetime* (not the classical spacetime we are familiar with), *matter* and *antimatter* and the *one fundamental force* were created. Matter and energy are concentrated in a very hot and dense point (gravitational singularity).

Cosmic inflation

The collapse of the primordial vacuum forces the *space* of this epoch to *expand* at an inconceivably fast rate, in an inconceivably short time.

[‡] *It is not known for certain whether our universe is in a false vacuum or a true vacuum (see *appendix* for definition), but current theoretical work, according to the Standard Model of particle physics, leans toward the possibility of a false vacuum.*

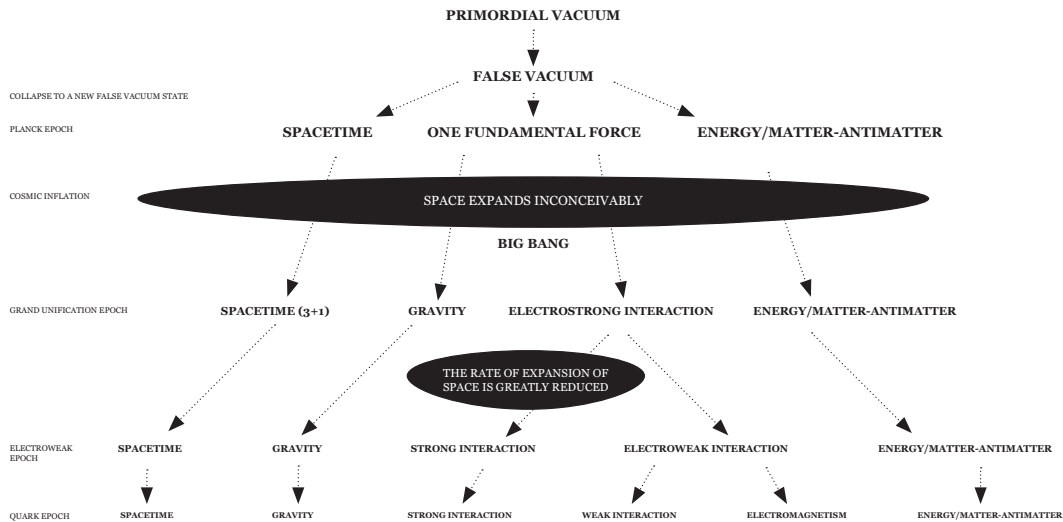


Diagram 1: *The standard cosmological model.*

By analogy, imagine that half the width of a DNA molecule (10^{-9} m) expands to a radius of 10.6 light years (100 trillion km) in one billionth of a trillionth of a trillionth of a second. This expansion is called *cosmic inflation*.

Big Bang

The end of cosmic inflation causes the temperature of the universe to *rise* (for the first and last time) from the interactions of the numerous new particles, which were created immediately after the end of cosmic inflation. This is the moment of the *Big Bang*. Spacetime has taken its familiar form (3 spatial and 1 temporal dimensions).

Grand unification epoch

(from $t=10^{-43}$ to $t=10^{-36}$ seconds)

Spacetime continues to expand, but at a slower rate. The drop in temperature causes the *universe as a system* to lose its stability and decay onto a new equilibrium level. This in turn *forces* the one fundamental force to manifest as two separate interactions: *gravity* and the *electrostrong interaction*.

Matter and energy are in the form of a very hot plasma. Within the plasma, particles of matter and antimatter (electrons-positrons, quarks-antiquarks, etc.) are created, collide with each other and then annihilate over and over again. There is, however, a *timeless mechanism*, not yet understood, which creates the conditions for *matter to gradually dominate over anti-matter* by not annihilating all of the matter particles.

Matter still has no mass or electric charge, and the energy in this period is in the form of radioactivity emitted by the annihilation of particles and antiparticles.

From Einstein's well-known equation, $E=mc^2$, matter and energy are different forms of the same thing, so this period has *four elements*: ***spacetime, energy/matter-antimatter, gravity, the electrostrong interaction.***

Electroweak epoch

(from $t=10^{-36}$ to $t=10^{-32}$ seconds)

Spacetime is expanding, at a slowing rate. At the same time, the temperature continues to decrease, causing the system of the universe to lose its stability and decay to a new equilibrium level, causing the electrostrong interaction to separate into two different forces: the *strong interaction* and the *electroweak interaction*.

Gravity still exists and matter is still in a plasma state, consisting of *quarks* and massless *gluons*. It is also at this time that the *Higgs boson* appears. *Photons* are not yet discrete particles.

So, in this epoch there are 5 elements: ***spacetime, energy/matter-antimatter, gravity, the electroweak interaction, the strong interaction.***

Quark epoch

(from $t=10^{-32}$ to $t=10^{-5}$ seconds)

Spacetime is expanding and therefore the temperature continues to fall, and as a result, the equilibrium of the system is once again disturbed. The system collapses to a more stable state, where the electroweak interaction is separated into two distinct interactions: the *weak interaction* and *electromagnetism*.

Gravity and the strong force remain, while *matter acquires mass* and photons become discrete particles. However, nuclei have not yet formed, so matter is still in a plasma state.

So in this period there are 6 elements: ***spacetime, energy/matter-antimatter, gravity, the strong interaction, the weak interaction, electromagnetism.***

Later epochs

The basic changes for the next periods are limited to *transitions of matter into more stable and complex structures*. The four (4) basic interactions remain constant, while spacetime continues to expand at a slowing rate, but after 8.8 billion years, the rate becomes *accelerating*. At each stage, the temperature of the universe falls steadily down to the current value of 2.7 degrees Kelvin above absolute zero, which prevents the creation of new matter-antimatter pairs on large scales. The key points of the following epochs are as follows:

*Between **2 minutes and 20 minutes** after the Big Bang, the first nuclei are formed. Antimatter is now found only in spontaneous particle-antiparticle creations, were the created pairs are immediately annihilated.*



*About **370,000** years after the Big Bang, **light** emerges from the opaque plasma of matter and energy. The first **atoms** are formed.*



*During the next **3 million years** radiation cools to the point where photons redshift out of visible light to infrared. The universe becomes truly dark. This period and until the formation of the first stars is called the **Dark Ages**.*

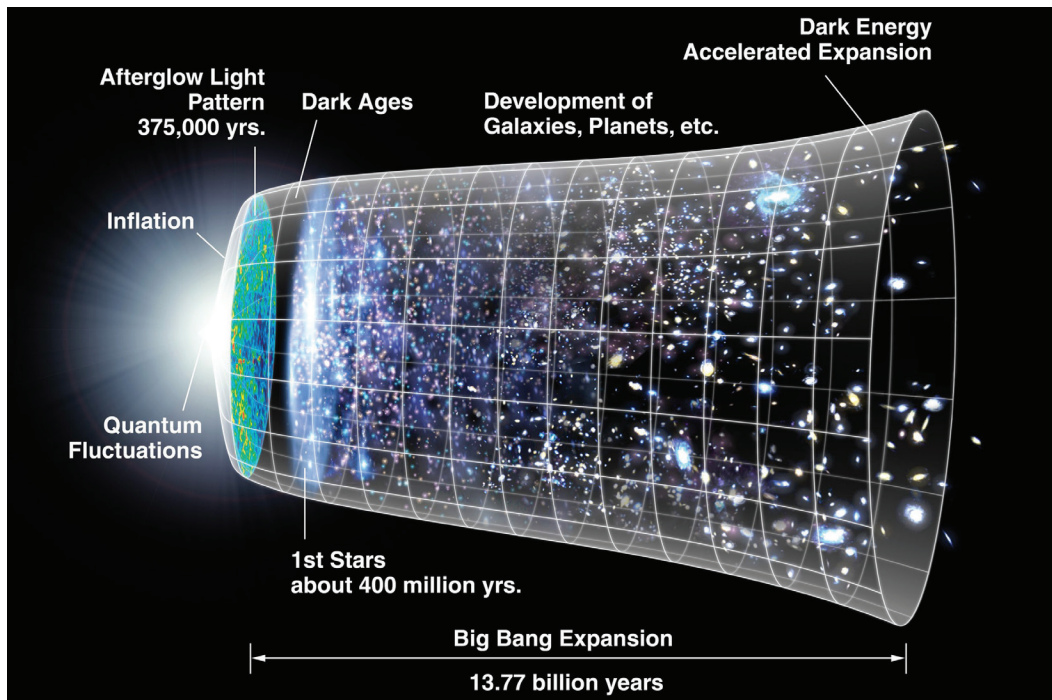


After about **200 to 300 million years** after the Big Bang, the first **stars** are formed.

8.8 billion years after the Big Bang, the Universe is expanding at an **accelerated rate**.

Our **solar system** is created about **9.2 billion years** after the Big Bang, and the **Earth** after **9.3 billion years**.

About **10 billion years** after the Big Bang, the **first life forms** appear.



NASA/WMAP Science Team - Original version: NASA; modified by Cherkash

New physics

In addition to the standard cosmological model, there are some more modern theories, which, although not widely adopted, attempt to explain the beginning of the universe and its early epochs based on physical models that are at the forefront of scientific research. Below, we will list two of them, which are accepted by the scientific community and are most consistent with the Pythagorean philosophy.

Informational cosmology

Information has a dual nature: one is *visible information* and the other is *hidden information*. Based on this theory, all statistical, scientific (physical, chemical, biological, medical) effects are tangible expressions of *maximized information*. These may be viewed, alternatively, as accomplishing minimization of its loss after transmission of certain particles over a channel. Thus, all spontaneous emergence of quantum particles from false vacua can occur via a *variational principle of minimum loss of information*.

Based on this principle, all material existence in the universe, including life forms, are physical manifestations of *information*. Also, most of the existing fundamental laws of physics, as well as some new and existing laws of biology, chemistry and economics, can be derived from information. In other words, *information can be treated as a physical quantity*, like mass, or energy. For example, space and time are emergent entities from information. Furthermore, information has an optimal representation in the physical world with a space of 3 spatial dimensions, and if the temporal dimension is added, then there is the familiar 4-dimensional (3+1) spacetime.

Anton Zeilinger, Nobel Prize-winning physicist, said: “What I believe but cannot prove is that quantum physics requires us to abandon the distinction between information and reality.”

Ekpyrotic universe

This model for the Cosmogenesis is based on string theory. Specifically, it states that the universe is a *4-dimensional brane* (3 spatial and 1 temporal dimensions), which is contained within a *5-dimensional bulk* (4 spatial +1 temporal). In the beginning, the brane that will become our universe is called the *visible brane*, and there is another 4-dimensional brane called the *hidden brane*. At some point, a *third 4-dimensional brane* peels away from the hidden brane, or it may have already existed in the bulk, and according to the model, travels through the bulk towards the visible brane at the speed of light and eventually collides with it, causing the Big Bang. The energy of this explosion is not infinite, but finite with a specific value, which is less than that of the energy level of the grand unification epoch. So, immediately after the Big Bang, Cosmogenesis goes through the grand unification epoch and then the universe evolves according to the standard model. Eventually, however, according to the model, when the universe reaches a vacuum state, there is another Big Bang in the same way (after an exponentially long time). Hence the universe is *cyclical* and recurrent and is born again and again “*out of fire (ekpyrotic)*”.

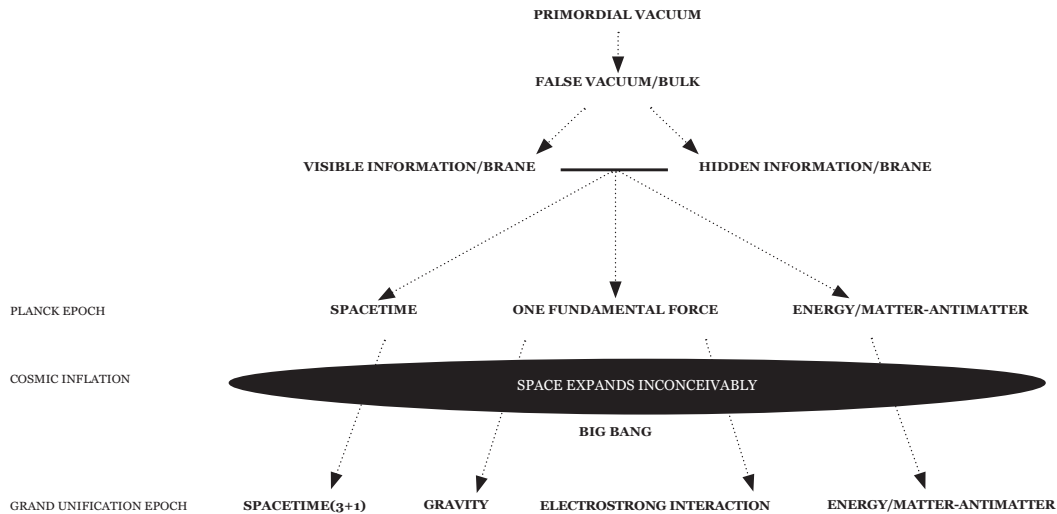


Diagram 2: Combining the standard cosmological model with the two new physical theories, the above diagram is obtained. After the era of the great unification the universe evolves according to the established cosmological model.

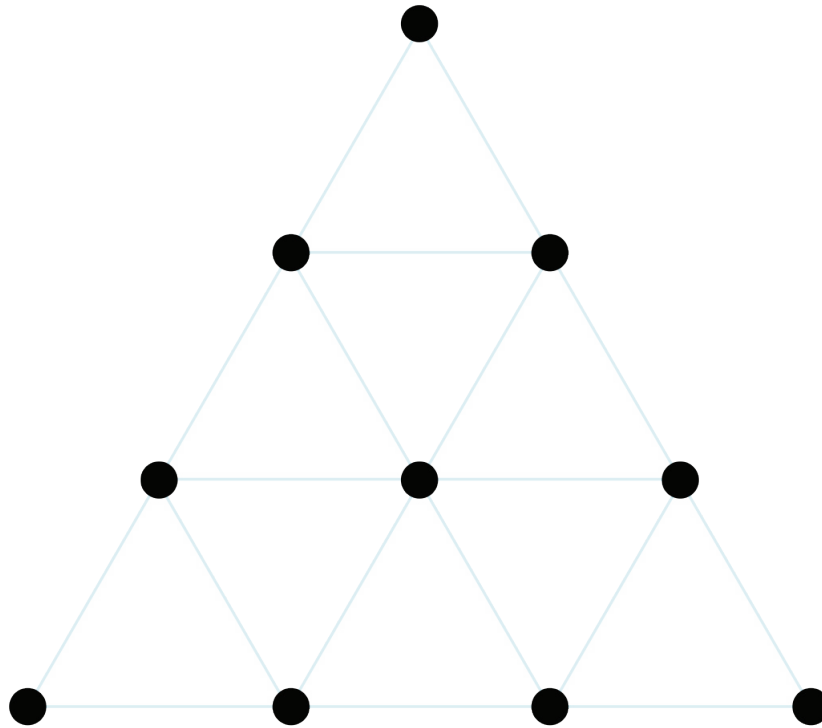
Ananke (Necessity)

One characteristic which is found unchanged in the epochs of the Cosmogogenesis, as described earlier, is “*Ananke (Necessity)*”. The epochs have variations from one to another, caused by the decay of energy from period to period, without outside interference. The only reason which could explain this fact is the existence of the endogenous “Ananke”. This is the reason why the universe is evolving in the way described above. Every energy decay, every new particle, every interaction, and even spacetime itself exists because “Ananke” ordained it so.

Also, information stems from the concept of probability, and when something has a non-zero probability, then at some point that something *will manifest*, i.e. whatever might happen, will happen (*because “Ananke” ordained so*). Even *Plato*, in his work *The Republic*, presents the goddess Ananke as carrying on her knees an adamantine spindle, which dictates all the rotations of the celestial bodies. Also, in his work *Symposium*, he states that before Eros ruled over divine things, only “Ananke” reigned and that everything happened under her rule.

Pythagorean philosophy

Pythagoras himself, in order to create his mystic path, combined different knowledge in order to achieve the best possible result. Therefore, the *mystic* development of the initial periods of Cosmogogenesis will be based, on the one hand, on scientifically unproven theories-conjectures, and on the other hand, on the philosophy of the Pythagorean esoteric path, which is presented by the *Tetractys* and on which all the mystic rituals of the Tagma (Order) Ermeas TrisMegistos are based.



Tetraktys

Mēdén (not monad/not one)

To the primordial vacuum, the state before the false vacuum state, the Tagma Ermeas TrisMegistos assigns the term “*Mēdén=not Monad/One*” and considers it incomprehensible for the human hypostasis (scientific or philosophical) and therefore does not symbolize it anywhere.

Monad

As mentioned, all the different prevailing scientific theories of the early periods of the universe, as presented above, are consistent with “Ananke”. Therefore, the Tagma Ermeas TrisMegistos considers “Ananke” to be the “*Singularity-manifested Mēdén*” and the Order assigns to it the term “*Monad*”, which corresponds to the scientific term false vacuum. “Ananke” is and contains everything and governs everything that manifests itself in the course of the Cosmogenesis.

Dyad

According to the theory of informational cosmology and the theory of the Ekpyrotic universe, there are *two elements* that interact to create the Cosmogenesis. In the first theory these are the visible information and the hidden information. In the second, it is the visible brane and the hidden brane. The existence of the *dyad* in Cosmogenesis also exists in Pythagorean philosophy and the Tagma Ermeas TrisMegistos places the mystic concepts/states: visible information-hidden information and visible brane-hidden brane, on the *second level* of the Tetraktys.

The visible information/visible brane and the hidden information/hidden brane could

be the inspiration of: good (heaven-coexistence with God) and evil (hell-great disorder) of the Christian religion. Also, the male pole (solar aspect-conscious) and the female pole (lunar aspect-unconscious) of the Jungian archetypes. However, in this epoch of the Cosmogogenesis there is no *Calculation* and therefore no *Law*, so these concepts do not belong to the level of the Dyad.

Hidden information is *infinite*, and no matter how much of it is revealed, it remains infinite. Visible information is *finite* and its quantity depends on *entropy*. When a system is observed it has an entropy (how much additional hidden information needs to become visible to be fully described/understood) and a quantity of information that already exists (visible information). If somehow the entropy of the system is increased (its disorder is increased) then the visible information that existed before can describe the system to a much lesser extent and accordingly the additional hidden information needed to understand the system has increased. That is, *an increase in entropy causes a loss of visible information*.

In the mystic course, the mystic is first called upon to *experience* all the existing visible information of their environment, and then, through the Mysteries (*production of work*), to *reduce* the entropy (of their environment) and *move towards the source of everything*. Consequently, although they increase the amount of visible information, they use less of it, because to experience the level corresponding to less entropy (and thus more order), they need less information. That is, *the smaller amount of information used is able to fully describe the mystic course*.

The mystic experiences the existing visible information of their environment through the properties of: the great unification epoch, the Planck epoch (interpretation follows), Quintessence (interpretation follows). In practice, through the Mysteries, mystics increase their energy (production of work) to move to a higher level with less disorder than that of the real world, at which level they fully possess its properties (visible information of that level). This results in an increased possibility of potential creation. In other words, the mystic path leads to the level where *visible information explains everything and hidden information can potentially create everything*.

The basic tool of the participants in the mysteries is their *attunement with “Ananke” at the “Monad” level or the “Quintessence” level, and with the flow of the “Ananke” from the “Triad” level onwards* (interpretation follows).

Hidden information and visible information, as well as hidden brane and visible brane, are interrelated. They may be perceived, in the context of the Mysteries, as two separate symbols, two separate points in the Tetractys, but in reality they have *one hypostasis*. All because “Ananke”, or the flow of “Ananke” ordained so.

Quintessence

Between the second and third level of the Tetractys, i.e. between the level of visible/hidden information - visible/hidden brane, and the level of the Planck epoch (interpretation follows), there is a *mystical position*, which is not symbolized in the Tetractys (it is only a deliberate position and not a natural one in the Pythagorean mystic path), but it is important for the Pythagorean Mysteries. It is *the point from which all the rituals of the Order originate*.

The Tagma Ermeas TrisMegistos defines this point as “Quintessence”. It is the point that represents the minimum visible information necessary for the subsequent evolution of the Cosmogogenesis. At this point, information can be experienced and used. In the established model, it is the point where the false vacuum transitions to the more stable state with the lowest energy. Always under the decree of “Ananke”. Everything that is performed within the Pythagorean Order emanates from “Quintessence”, which is symbolized differently depending on the degree of initiation.

At the point of “Quintessence”, the Tagma Ermeas TrisMegistos places the *Spiritual World*, where the *Celestial Brotherhood* resides. The properties of this point are expressed in a different way in all the subsequent epochs of the Cosmogogenesis and are the following:

QUINTESSENCE

DIVINE PLAN

CONSCIOUSNESS

GNOSIS/KNOWLEDGE

ENERGETIC FANTASY

HYGEIA/HEALTH

COMMUNICATION

BROTHERHOOD

Triad

Scientific theories state that when the vacuum decays into its fundamental state, the most stable one with the lowest energy, then a spacetime, the one fundamental force and energy/matter-antimatter emerge (Planck epoch). In the Pythagorean Tetraktys this epoch of the Cosmogensis is symbolized in the *third level*, i.e. in its *three* points. The Order places in this epoch *the properties of the Spiritual World*, which the Celestial Brotherhood uses, helping the flow of “Ananke” to prevail and thus aiding the functioning of the universe.

Mysteries, *transcendentally*, are performed (created) on this level. It is the level of *creation being created and at the same time itself creating*. The performer of a Rite rises ritually to this level and performs their mystical work, *attuned to the properties of the creation being created/creating*. This point is defined by most traditions as the beginning of everything: “*In the beginning was the Word (Logos)*”, *Jungian archetypes*, *Plato’s realm of ideas*.

The properties of the elements, which are manifested at this epoch of the Cosmogensis, other than those mentioned in the appendix, and which are used by both the Celestial Brotherhood and the performer of the ritual, are as follows:

SPACETIME	ONE FUNDAMENTAL FORCE	ENERGY/MATTER-ANTIMATTER
SYNCHRONICITY	THE EXISTENCE OF TIME	EROS
PLAN IN A FRAMEWORK	BROUGHT THE “BEFORE” & THE “AFTER” AND THEREFORE	POWER
MNEMOSYNE	THE LAW OF CAUSE-EFFECT/ ACTION-REACTION	HARMONY
BEAUTY	RHYTHM	
	COMPUTATION	
	WILL	
	EXPANSION	

Between the Triad and the Tetrad

At the stage of cosmic inflation we pass to the *created creation*. During the inconceivable expansion of spacetime, the *Astral World* is created in parallel.

Tetrad

The scientific theory then continues with the grand unification epoch. According to the theory, gravity and the electrostrong interaction emerge from the one fundamental force. In the Pythagorean Tetraktys this period of the Cosmogensis is symbolized at the *fourth level*, that is, in its *four* points, which reveal *the four Pythagorean Elements*.

The Order places in this epoch *the properties (manifestation) of the Astral World*, which, used by the Celestial Brotherhood, help in the prevalence of the flow of “Ananke” and thus in the functioning of the universe. *The entities of the Astral World* and their actions are not the subject of the present work, but the reader would be well advised to be aware of their

existence.

The Mysteries, in the anthropocentric-earthly manner, are performed on this level, with the aim of receiving the energy of Transmutation (production of work) and of ascending towards the less used visible information, as mentioned above. The performer of the Rite transfers, ritually, to the participating members, the charge to achieve their transmutation at this level. According to the Tagma Ermeas TrisMegistos, the Rites *do not purify*, but *charge* the members, so that by their own action they can ascend in the direction of using less visible information.

The properties of the elements which are manifested in this epoch of the Cosmogonesis, besides those mentioned in the appendix and in the previous epoch, are as follows:

SPACETIME	GRAVITY	ELECTROSTRONG INTERACTION	ENERGY MATTER-ANTIMATTER
SYNCHRONICITY WHICH FRAMES THE INCARNATION AND THE LIFE IN THE ASTRAL WORLD	IT IS AND AT THE SAME TIME CREATES THE FIELD WHICH GIVES DIRECTION	ATTRACTION-REPULSION	PASSION
CONSCIOUS-UNCONSCIOUS	PATH	INSTINCTS-REFLEXES	INSPIRATION
EMOTIONAL PATTERN	LOGIC	ACCEPTANCE	INTUITION
MEMORY	TRANSCENDENCE	EMOTION	FANTASY
ELEMENT: EARTH	FRIENDSHIP	DESIRE	ELEMENT: FIRE
	ELEMENT: AIR	ELEMENT: WATER	

The members of the Pythagorean Order Ermeas TrisMegistos, through the Rites, *aim to attune themselves to “Ananke”-flow of “Ananke”, charged with the properties of the elements that created the Cosmos. Through experiencing “Ananke”-flow of “Ananke” they come into contact with both the properties of the Spiritual World and the Celestial Brotherhood, which is their guide.*

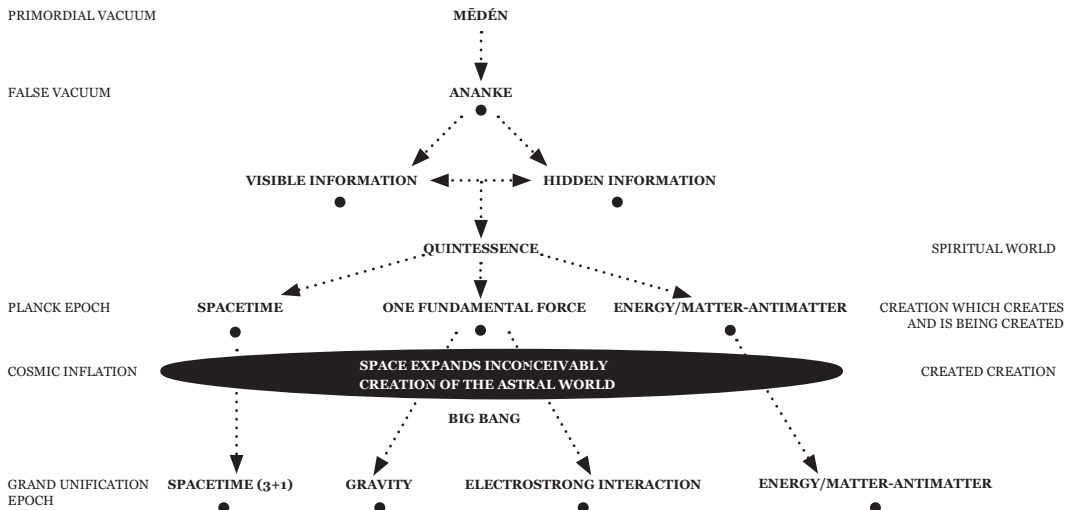


Diagram 3: *The mystical development of the early epochs of Cosmogonesis based on the scientifically unproven theories-conjectures and the philosophy of the Pythagorean initiatory path, which is presented by the Tetractys.*

Appendix of scientific terms

Antimatter: Antimatter is the form of matter that consists of antiparticles. Each particle of matter is associated with an antimatter particle. Antiparticles have the same mass as their matter counterparts, but opposite charge. When particles collide with antiparticles, they annihilate each other, emitting photons.

Bosons: Subatomic particles whose spin is an integer (0, 1, 2...). They have positive, negative, or zero electric charge. Some bosons are also elementary particles which are carriers of interactions between other particles.

Brane: In string theory, a brane is a physical object that generalizes the concept of a zero-dimensional point particle, the one-dimensional string or two-dimensional membrane, to higher-dimensional objects. A particle is a 0-brane of dimension zero. A string is a 1-brane. A membrane is a 2-brane, while the corresponding object of arbitrary dimension N is called an N-brane. Branes are dynamic objects that can propagate through spacetime according to the rules of quantum mechanics. They have mass and can have other characteristics such as charge.

Electromagnetic interaction: It is the interaction between particles that have an electric charge. It is the dominant interaction between atoms and molecules.

Electrostrong interaction: In the theoretical models of the grand unified theories (there is no standard one), 3 of the 4 fundamental interactions, the strong interaction, the weak interaction and the electromagnetic interaction, and at very high temperatures (which we cannot achieve experimentally), merge into one: the electrostrong interaction. The existence of this interaction has not been proven theoretically, or experimentally.

Electroweak interaction: The unified description of two (of the four) fundamental interactions of nature, namely the electromagnetic and the weak interaction. At the high temperatures of the electroweak epoch, these two fundamental interactions merge into one: the electroweak interaction. The existence of this interaction has been experimentally verified.

Energy: The quantitative property that is transferred into a system, or body and makes it capable of producing work. It is recognized in the form of heat and light. Energy can be converted into matter and vice versa.

Entropy: In general, entropy is the measure of uncertainty and disorder of a system and depends on the state of the observer/measuring instrument. This means that physical systems have no intrinsic entropy; it is, therefore, an anthropomorphic concept. In particular, the entropy of a system is the number of ways in which a system can be microscopically configured without changing its macroscopic state. Equivalently, the entropy of a system is the expected amount of missing information (hidden information) required to determine the microstate from the macrostate of the system. That is, it is the expected amount of hidden information that must become visible to determine the system. There is, therefore, an inextricable link between entropy and information: the less entropy a system has, the more information we have about it. And conversely, the more entropy, the less information we have about it. Finally, the entropy of a system cannot be reduced without transferring to it external energy.

False vacuum: In quantum field theory, a false vacuum is a hypothetical vacuum state that is locally stable, but does not occupy the most stable possible fundamental state. This false vacuum state can last for a very long time, but the vacuum could eventually decay to its most stable state with the least possible energy.

Gluons: Elementary particles with spin 1, zero mass and zero electric charge. They are particles that carry the strong interaction with which quarks interact.

Gravity: Observed primarily as the mutual attraction between everything that has mass. The general theory of relativity describes it more precisely, not as an interaction, but as the curvature of spacetime, caused by the uneven distribution of mass within it, which causes masses to move on geodesic curves (curves that connect two points in spacetime with the smallest possible distance).

Higgs boson: An elementary particle with mass, zero spin and zero electric charge. It is both a particle and an antiparticle. It contributes to the effect of mass of particles.

Information: It is the quantitative property whose presence allows predictions to be made more accurately than that of chance. Any natural process that is not completely random and any observable pattern in any medium can be said to carry some amount of information. From the above definition it can be seen that information is dependent on the observer/measuring instrument and thus is a subject-centered approach to reality. Also, information satisfies the following postulates:

1. An event with probability 100% is perfectly unsurprising and yields no information.
2. The less probable an event is, the more surprising it is and the more information it yields.
3. If two independent events are measured separately, the total amount of information is the sum of the self-informations of the individual events.

Based on the above postulates, information can be interpreted as the quantification of the degree of surprise of a particular outcome/event. Information is measured in bits.

Leptons: Elementary particles with spin $\frac{1}{2}$ that are not affected by the strong interaction. They have mass and may or may not have an electric charge. Electrons are a type of lepton with an electric charge.

Matter: Anything composed of quarks and leptons. Light, heat, sound and other energy phenomena are separated from matter. Matter can be converted into energy and vice versa. In the Standard Model of particle physics, matter is not a fundamental concept.

Neutron: An atomic particle with mass and zero electric charge. It consists of three quarks. Together with the proton, it forms the nuclei of atoms.

Photon: The elementary particle (boson) of spin 1 that is the carrier of electromagnetic interaction (e.g. light, radio waves, microwaves). It has no mass and no electric charge. It moves at the speed of light. A photon is both a particle and an antiparticle.

Plasma: It is one of the 4 fundamental states of matter (the others being gas, liquid, solid) and is characterized by the presence of charged particles (ions or electrons). It is the state of matter that is more abundant than the others in the universe (especially in stars).

Proton: A subatomic particle that has mass and a positive electric charge. It consists of three quarks. It forms, together with the neutron, the nuclei of atoms.

Quarks: Elementary particles with spin $\frac{1}{2}$ that make up the basic elements of matter, namely protons and neutrons. They have mass and electric charge.

Second law of thermodynamics: This law states that there can be no heat flow from a cold point of a system to a hot point of that system without the production of work by some

agent outside the system. The consequence of this fact is that the entropy of a closed system, which evolves spontaneously, cannot decrease (although there is a very small, non-zero probability that this can happen). Therefore, the universe started with a minimum entropy value and from then on its entropy increases until it reaches its final maximum value (thermodynamic equilibrium of the universe/heat death).

Spacetime: A mathematical model that merges the three dimensions of space with the dimension of time into a single four-dimensional continuum.

Spin: An intrinsic form of angular momentum of elementary particles and thus of atoms.

Strong interaction: It binds (unifies) quarks into protons, neutrons and other subatomic particles. It then binds (unifies) protons and neutrons into atomic nuclei, i.e. holds the nuclei together.

Thermodynamic equilibrium: A state of a system in which there is no change (no flow of matter or energy within the system or to and from the system from other external systems). Moreover, in addition to not changing, the system has no tendency to change. The temperature throughout the system is constant and uniform.

Vacuum state: In quantum field theory, the vacuum state (also called the quantum vacuum or quantum vacuum state, or true vacuum) is the quantum state with the lowest possible energy and is therefore the most stable. According to modern science, the vacuum state is not a simple empty space, but instead contains fleeting electromagnetic waves and particles that appear and disappear, i.e. it still has quantum fields.

Weak interaction: The interaction mechanism of subatomic particles that is responsible for the radioactive decay of nuclei. The weak interaction is involved in nuclear fusion and fission.