

The Opening up of Recent Physics to the Eastern Patristic Cosmology

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Abstract

The paper approaches several aspects related to the beauty, comprehensibility and unity of the physical world, as reflected in the field of sciences and highlights their relevance in terms of spirituality, from the particular perspective of eastern Christian theology. The author makes several comments on the possible convergence between the computational cosmological model, the description of the world as a living organism, a view held in Greek antiquity (Plato) and the spiritual meanings of Creation, from the standpoint of Christian patristics. The article also features observations from the view of patristic theology on the scientific representations of the world and their consequences.

Keywords: rationality of the Universe, beauty of scientific theories, unity of the world, Orthodox theology of Creation

Résumé

L'article traite de plusieurs aspects liés à la beauté, compréhensibilité et unité du monde physique, comme reflétées dans le domaine des sciences et met en évidence leur importance sur le plan spirituel, du point de vue particulier de la théologie chrétienne orientale. L'auteur fait plusieurs remarques sur la convergence possible entre le modèle cosmologique computationnel, la description du monde comme organisme vivant, idée de l'antiquité grecque (Platon) et les significations spirituelles de la Création, de la perspective de la patristique chrétienne. L'article inclut aussi des observations du point de vue de la théologie patristique sur les représentations scientifiques du monde et leurs conséquences.

Mots-clés: rationalité de l'Univers, beauté des théories scientifiques, unité du monde, théologie orthodoxe de la Création

1. The beauty and unity of the physical world

The differences between the microcosm and the macrocosm might suggest that there exist several worlds. One might believe, for example, that there is a world of very large objects, where gravitation dictates all processes. This is the realm of the largest and densest objects in the Universe – the gigantic celestial bodies, neutron stars or black holes. Scientific theories show that in this world, space is extremely curved and time flows more slowly than we normally expect. In such areas, there are no atoms, molecules or anything resembling the diversified chemistry of our environment. Still, there are sub-nuclear particles, plasma, nuclear reactions, enormous temperatures and pressures and tremendous densities.

One might say that there is also a world of the smallest objects, which includes the ultimate constituents of matter, minuscule concentrations of energy which do not look like anything that direct experience reveals about the world we live in. These elements feature a dual make-up, at times behaving as though they were corpuscles, and at other times as waves. In fact, things in this world have characteristics that are incomparable to those found on the natural scale. This is the quantum world.

Such a classification might be justified up to a point, as these two worlds are genuinely different. Their differences are visible also in their underlying scientific theories. For example, the gravitational world is different from the quantum world. The objects in the two worlds – the stars and elementary particles respectively – have distinct characteristics and behave differently, even though the former are ultimately gigantic aggregates of matter composed of the latter. The general theory of relativity describes the force of gravity and the structure at the large scale of the Universe, whereas quantum mechanics deals with phenomena at an extremely small scale. Either of these two theories maintains part of the “classical” meaning attached to physical reality, yet exactly the meaning that the other theory contradicts. General relativity does not make any

reference to Heisenberg's uncertainty principle¹ or to the interaction between the observer and the observed system. On the other hand, in quantum theory, the uncertainty principle is indispensable and the interaction observer-observed quantum system is unavoidable². Additionally, whereas general relativity operates with macroscopic objects and real time, quantum mechanics operates with dual corpuscle-wave entities and an imaginary time, introduced by mathematical calculation³. Likewise, in general relativity, space is a distorting texture, which curves in the proximity of dense objects, while in quantum mechanics space is a fixed background. According to the uncertainty principle employed in quantum mechanics, the whole space is subjected to quantum fluctuations, therefore the gravitational field as well. While general relativity suggests that empty space means a zero gravitational field, quantum mechanics indicates that its actual value varies, due to quantum fluctuations. Moreover,

¹ The theory of mechanics describes what direct experience is able to test: the position and speed of an object can be measured in relation to a specific benchmark, a time scale and a distance standard established in advance. The outcome however is not valid at the level of the smallest constituents of matter. W. Heisenberg concluded that it is impossible that, in a single experiment, one may determine, simultaneously the *position* and the *momentum* of a particle, with *absolute precision*. According to the uncertainty principle, if an experiment determines with absolute precision the position of an electron, then its velocity remains completely uncertain. Conversely, if velocity is determined with absolute precision, the position will not be known, as if the corpuscle were constantly hiding as a result of some flawless process. Uncertainty is always greater than a numerical value which is equal to the Planck constant. A similar uncertainty relationship, obtained by starting from the formal design, is established in the relation between *energy* and *time*. If the time interval focused on a precise moment is shorter, the measurement of the energy of the observed system is increasingly less accurate. Furthermore, if one aims for an accurate measurement of a quantum system, one will not be able to define the moment when it has that particular value.

² Cf. Lee Smolin, *Spațiu, Timp, Univers. Trei drumuri către gravitația cuantică* [Space, Time, Universe. Three Roads to Quantum Gravity], Humanitas, București, 2002, p. 13.

³ Imaginary time does not necessarily have a concrete significance. Its introduction into the formal calculation of quantum mechanics was made on practical grounds. Cf. Stephen W. Hawking, *Scurtă istorie a timpului. De la Big Bang la găurile negre* [A Brief History of Time. From the Big Bang to Black Holes], 4th Romanian edition, Humanitas, București, 2001, p. 162.

based on the uncertainty principle, the extent of gravitational field oscillations rises increasingly the smaller the space regions involved are. Consequently, “these undulations in tiny distances are so violent that they completely destroy the flat spatial geometry, playing in central role in the general theory of relativity”⁴.

Lastly, general relativity cannot describe end points, such as the Big Bang, as there it faces an infinite mass-energy density. In these special areas, the concepts it operates with cannot provide any explanation (a situation where points are known as *singularities*), proof that the theory is used beyond its scope⁵. There are no singularities however in quantum mechanics⁶.

All these distinctions point to the fact that the current theories which shape our understanding of the Universe do not exactly follow one from another. On the contrary, there is something that might be called “levels of reality”, because there are missing pieces of the science “puzzle” describing reality. In this respect, certain authors suggest considering several levels of reality⁷.

From a theological perspective however, this multitude of levels reveals something else. Neither in the senses’ perception ability, nor in the mind’s power of understanding and in the far-reaching capacities of the inner self, and even less so in technology, can man find something that might help him to

⁴ Brian Greene, *Universul elegant. Supercorzi, dimensiuni ascunse și căutarea teoriei ultime*, [The Elegant Universe. Superstrings, Hidden Dimensions and the Quest for the Ultimate Theory], Humanitas, București, 2008, pp. 146-147.

⁵ Brian Greene, *op. cit.*, p. 414.

⁶ Stephen W. Hawking, *op. cit.*, p. 156. Relativity “does not take account of the uncertainty principle of quantum mechanics. The reason that this does not lead to any discrepancy with observation is that all the gravitational fields that we normally experience are very weak. However [...] the gravitational field should get very strong in at least two situations, black holes and the big bang”. *Ibidem*, p. 81.

⁷ The levels of reality are considered to be “a set of systems constantly governed by a number of general laws; for example, quantum entities subject to quantum laws, which are radically different from the laws of the macrophysical world. [...] two levels of reality are different if moving from one to the other entails a breakdown of laws and a breakdown of fundamental concepts (such as causality)”. Basarab Nicolescu, *Noi, particula și lumea* [Us, the Particle and the World], Polirom, 2002, p. 102.

achieve a connection between these different levels. As long as the world remains fragmented, into distinct territories with no particular relation to man, it cannot appear as an open and oriented space, appropriate for a conscious and free subject who is able to know. However, man's life in the world also cannot be viewed anymore as an edifying experience, as a ladder leading to an understanding of its ever higher meanings and to a higher purpose. Man's life seems to be an accident – a personal issue, unfolding somewhere between the levels of this stratified reality – bordered by impassable gulfs separating it from the microcosm and the boundaries of the Universe. It cannot account for the fact of his existence and cannot guide man towards its origins.

How could all these levels of reality, these planes of the world and life be integrated? The Christian perspective is highly relevant here, because the world is created *ex nihilo*, by the Word of God, the Logos. Creation is not disparate, fragmented, but rather a work and a *coherent conversation* of the Trinity of Persons with man. From the perspective of the sciences even, there are certain outcomes and approaches that strongly suggest the unified character of the physical world! Here is a handy example: the flame of a matchstick and the drop of water that extinguishes it. They might seem to have opposite natures, yet they are composed of *exactly* the same elementary particles. They are not made of the same atoms, obviously, yet both possess protons and electrons! The difference between the flame and water consists in how these constituent “building blocks” are grouped. Generally, physics shows that all the diversity of structures and textures existing in nature is made up of a few elementary particles. Another, more wide-ranging aspect: although according to the natural scale, the worlds of rays of light and rain drops are very different, both rain drops and light radiation – and more generally, the objects of the material world and fields of forces – are comprised of entities with a similarly dual constitution, as *corpuscle* and *wave*, or *wave-corpuscle*. Similarly, in quantum mechanics, the separation between the observer's action and the result of his measurements is impossible. The observer can measure the parameters of a quantum system

only by interfering, which means that there is a connection the observer and the observed system, creating an *observer-observed system* couple. Other physical aspects that seem separate are in fact intimately related. Strictly speaking, matter and energy are not separate, as they are the same thing in essence, which is why physics operates with *matter-energy*. On the other hand, at macroscopic level space and time cannot be examined separately and therefore general relativity operates with *space-time*. Moreover, space-time and matter-energy are closely connected because, in a zone of high-density matter-energy, space-time characteristics are significantly modified. Matter, space and time were long understood and represented separately, based on the nature of our experience. Nowadays, however, physics deals with *space-time-matter-energy*.

From a theological perspective, a theory that would unite interactions and integrate all scientific descriptions of the Universe, while not, of course, the ultimate goal of knowledge, can nevertheless suggest that the physical laws valid at various levels are destined to be connected with each other by a conscious subject, who is able to know and absorb them, because he can see into them and discern their 'kinship'. Yet this work, of discerning the distinct frames of reality, i.e. the micro and the macrocosm, and man's struggle to unite them do not manage to unite the poles of creation and people among themselves. This union is fulfilled in proportion to the spiritual effort aiming for the union of the things, powers and designs in the created world and of people with God. This union is possible in Christ the Logos and through the grace of the Holy Spirit, which pervades all things.

According to St. Maximus the Confessor, man was destined to unite the poles of Creation. He was to achieve the union of male and female, man and woman, paradise and earthly world, sky and earth, the intelligible and the sensitive, and, ultimately, the union of the Created and the Uncreated. St. Maximus maintained that by living in Christ man could bring together these poles of Creation which incorporate all the other frames mentioned earlier. Spiritual life facilitates the union of the poles of Creation because in Christ all are united. Spiritual man is able to grasp and unite all things, as he can see them and be increasingly aware of their bond with Christ.

Therefore, through scientific research, the beauty of the world, the diversity of its patterns and their convergence somehow emerge ever more conspicuously. Theologically, however, the efforts aiming for unification in the field of sciences can orient reflection towards the communal life of people and of people with God.

Only the connection of everything existing with God Who created them meaningfully unites the created things, brings people into communion and leads their lives to fulfilment. Through the cleansing of passions and spiritual life, the world's unity becomes ever clearer in Christ, beyond the designs of the world and beyond the fragmentation of reality, without any other integrating effort, be it of a scientific, conceptual or methodological kind⁸. From the theological perspective, "ultimate union [...] encompasses the great talents people were endowed with at their creation when they were sent to labour in the vineyard (the world). They grew in the knowledge and in the humanity they received as an ideal and partly as a virtuality from the very beginning, working together in the world. They found places in themselves and in the world for the goodness and beauty of God, in keeping with their own capacity to receive and reflect them, while also actualising the potentialities they sowed in the world"⁹.

2. Creation – the school of man's spiritual progress

Man never ceases to seek ever deeper meanings and more inclusive answers about the foundations of the world and of life. The world itself, with all its limitations, proves to be constantly

⁸ This refers primarily to the views of certain researchers who state that the design of an all-encompassing scientific theory (*Theory of Everything*) could mean the fulfilment of all of man's knowledge needs and the complete explanation of the mysteries of the Creation, of life and consciousness (cf. Stephen Hawking, *O mai scurtă istorie a timpului [A Briefer History of Time]*, Humanitas, 2007, p. 77) There are many voices, even in the field of science, that have expressed disagreement with this position. (They include John Barrow, Roger Penrose, Michael Heller, Paul Davies). Yet this also relates to the transdisciplinary methodology, viewed as an intention to overcome the image of a world fragmented by the realisation of the existence of levels of reality.

⁹ Dumitru Stăniloae, *Introduction to St. Maximus the Confessor, Ambigua*, Romanian edition, Editura Institutului Biblic și de Misiune al Bisericii Ortodoxe Române, București, 2006, p. 58.

open to man's interrogations. The exploration into the depths of matter, the order of structures, the wealth of rationality or the advance towards ever farther reaches of the Universe all seem to provide endless opportunities. There are numerous elements which embolden man to follow the path of sciences: the efficiency of mathematical language in describing the phenomena of nature; the convergence of a considerable number of scientific outcomes towards a framework that incorporates all reality; and other singular situations, such as the compatibility of man's creative spirit with the surrounding nature, which seems to have been specifically set up as man's creative studio. Furthermore, both in the rarest and the commonest of details in the sensitive reality man always discerns new leads that open up to new avenues of research and also finds new structures or powers that can turn his creative ideals into reality.

Despite the significant differences between quantum mechanics and general relativity, theories of physics suggest that the world exhibits a deep imprint of unity. The properties that characterise the most intimate structures of the physical world match others, which apply to its most massive dimensions. Gravitation, which science has shown to be extending to the frontiers of the Universe, makes the stars shine, whereas the strong nuclear interaction, which never crosses the boundary of the nucleus, collects celestial matter, synthesizing new "materials", which explains the world's diverse chemistry. Electromagnetic interaction arranges atoms into genuine molecular edifices, creating the structures of nature and providing the sensitive foundation for life. Finally, in Earth's nature, living organisms bear the mark of their affinity, in their most intimate structures and simultaneously exhibit an extraordinary compatibility with terrestrial environment, this highly dynamic and complex medium of physical factors.

Moreover, the idea of the world's unity has deeper roots. The working patterns of the unification of forces which govern the world and make up its structures suggest the existence of a single interaction at the beginning of the universe¹⁰. On the

¹⁰ The shadow of the Cartesian method, approaching the world by separating its phenomena based on various criteria, accompanied the

other hand, the quantum inseparability leads to the idea that the unity of the physical world did not exist only in the past, at the Big Bang, but is still present in each particle in the Universe, until the end of times, as an indelible trace of primordial unity.

There are several theological references to these observations. First of all, it is significant that, from the scientific perspective, the union of interactions and the world's unified character is revealed at once with the diverse symmetries hidden in objects, in laws and in the elementary constituents of matter. In a way, the unified character of the physical world is closely matched by its beautiful organisation and by its various powers and properties which are brought together in a remarkably harmonious manner. So far, the scientific research strategy seeking all-encompassing descriptions of the physical world, in terms of symmetry principles, has been fruitful. In many respects, physical theories have proven that they are beautiful in many ways. Therefore, in numerous situations, the epic journey of knowledge has been guided by the belief in "the existence of an ultimate symmetry and ultimate simplicity of all the fundamental laws that govern the Universe"¹¹. Moreover, the entire history of science could be seen as a history of the search for "all-embracing, unifying concepts". Thus, "almost inescapably, the prevailing concepts were indeed the most aesthetically appealing"¹².

Obviously, the beauty of theories reflects the symmetries existing in the objects and powers of the physical world. Yet

emergence of the great 20th-century theories, i.e. relativity and quantum mechanics. As long as physics operates with theories developed separately, approaching the microcosm and the macrocosm distinctly, the outcomes will be unsatisfactory. The fact that general relativity does not say anything about the results of quantum mechanics makes it seem as though the two theories are mutually opposing. "General relativity appears to be fundamentally incompatible with [...] quantum mechanics. [...] the conflict alerts us to a fundamental deficiency in our conception of nature." (Brian Greene, *op. cit.*, p. 102.) If the theories about the world do not "meet" at all and do not validate each other, then they cannot achieve a fully coherent scientific description of the physical world.

¹¹ Abdus Salam, "Conceptul de simetrie și teoria fundamentală a materiei" [The Concept of symmetry and the fundamental theory of matter], in *Știința bun al întregii omeniri* [Science, the Common Heritage of Mankind], Editura Politică, București, 1985, p. 123.

¹² *Ibidem*.

symmetry principles, whose reach has already been proven repeatedly, may be more than that, according to Steven Weinberg: “an anticipation, a premonition, of the beauty of the final theory”. In any case, “we would not accept any theory as final unless it were beautiful”¹³.

3. The beauty of Creation reaches perfection in man's spiritual life

It is a well-known fact that although Greek philosophers had considerably less physics data about the universe, they still captured the order and beauty of the cosmos in superb fashion. Significantly, Plato summarised pre-Socratic conceptions in his theory on the cosmos, which he understood as “an animated, living being”¹⁴. Viewed in this manner, the universe is illustrative of life itself, as the whole cosmos is understood as a living subject¹⁵. In other words, for classical philosophical reflection the best solution to express cosmic beauty and order was to connect them to life itself.

Nowadays, the computational cosmological model, designed on the basis of infinitely greater amount of data and discoveries, depicts the universe as a gigantic computer which processes information¹⁶. Over time, therefore, although it has come to no longer be seen as similar to a living being, the universe still preserves the features of an intelligent “being”. On the one hand, the order and laws of the universe, the remarkable beauty of the theories which describe it, the coherence of the physical phenomena occurring in it somehow compel each observer to seek an answer, a symbolic meanings or a hermeneutic assessment that could encompass all these aspects in a single framework.

In patristic theology however, the beauty of the world ultimately consists in the manifestation of the spirit in the

¹³ Steven Weinberg, *Visul unei teorii finale* [Dreams of a Final Theory], Humanitas, București, 2008, p. 147.

¹⁴ Christos Yannaras, *Persoană și eros* [Person and Eros], Anastasia, București, 2000, p. 91.

¹⁵ *Ibidem*.

¹⁶ Seth Lloyd și Y. Jack Ng, “Computerele găuri negre” [Black Hole Computers], in *Scientific American*, Romanian edition, December 2004 - January 2005, p. 25.

matter¹⁷. Looking at the world from a spiritual perspective, one can see that man is the crowning of creation. Of all creatures, he illustrates to the greatest extent the beauty of the Creator, as he was created in His image and after His likeness. The greatest beauty, writes Romanian theologian Dumitru Stăniloae is “the propagation of the living spirit through the living body, which occurs when man’s body ceases to be ruled by materiality and his spiritual attributes become transparent and unobstructed by matter”¹⁸. This reflects why, according to eastern patristics, the beauty of the created world is essentially related to the human being and why man is the only being capable of understanding the nature’s symmetries and harmonies. Man alone can fully realise and see the beauty of the world and feel the protection of the Lord which radiates from the world’s beauty and wise organisation. Moreover, the beauty of creation does not only call for man to explore its origins and describe the laws that determine its forms. For man, the beauty of creation must also be perfected, in himself, through the cultivation of virtues, and in the world, through love for one’s neighbour and for God. Man is called therefore to “augment” the world’s beauty in communion, with the whole of Creation, with one’s neighbour and with God. “The Logos of the world’s perfect organisation, beauty as truth of beings”, writes the theologian Yannaras, “is not exhausted cognitively by a “semantic” definition (*arithmetical and quantitative*) arising from human logos, but is encountered by human reason (*logos*) within the context of a personal dialogue (*dia-logos*), a fact of personal relationship”¹⁹. Yannaras goes further, asserting that the beauty of the world is meaningless as long as it remains outside of personal communion. In such a case it is only a “tragic call” to the fulfilment of life which proves unattainable²⁰. “The more receptive to communion man is, the more tormenting the beauty of the world becomes – a tragic unquenchable yearning”²¹.

¹⁷ Dumitru Stăniloae, *Teologie Dogmatică Ortodoxă* [Orthodox Dogmatic Theology], 2nd ed., volume 1, Editura Institutului Biblic și de Misiune al Bisericii Ortodoxe Române, București, 1996, p. 293.

¹⁸ *Ibidem*.

¹⁹ Christos Yannaras, *op. cit.*, p. 97.

²⁰ *Ibidem*, p. 99.

²¹ *Ibidem*.

4. The beauty and unity of the physical world

Returning to the physical world, we can state that based on scientific evidence confirming the existence of symmetries of various kinds in creation, beauty is about to become effectively a key criterion in assessing future theories of physics about the Universe. It is also worth noting that for researchers engaged in unification theories, it appears ever more clearly that symmetry principles are not mere consequences of the laws known in physics but actually their foundations!

Let us look at this issue in more detail. On the one hand, this new situation suggests that the conventional mode and formulas of understanding the world might change. The perspective that the scientist today uses to observe and examine the world might be overturned. For example, we would not have to ask ourselves why in our universe the inertial mass is equal with gravitational mass, just as it might not make sense to wonder why someone in a lift without portholes in the outer space is not able to distinguish between the upward acceleration of the lift and the downward gravitational force²². It might therefore be more accurate to say that “gravity, in this view, exists in order that all possible observational vantage points are on completely equal footing—i.e., so that the equivalence principle holds. Similarly, the non-gravitational forces exist in order that nature respect their associated gauge symmetries”²³.

On the other hand, however, it is important to point out that by all these cases of opening up, the questions of the sciences of physics are broadening to an unexpected degree. First, by probing the core of things and researching the constituents of the world, recent physics has appropriated, to a certain extent, part of the focus of ontology²⁴. Further, by targeting even more general aspects, such as space-time characteristics, nature of vacuum, the uncertainty principle or the relationship between the phenomena of the physical world

²² For additional details refer to Brian Greene, *op. cit.*, p. 392 sqq. The idea is also mentioned by Steven Weinberg: “[...] the symmetry between different frames of reference requires the existence of gravitation” (*Op. cit.*, p. 129).

²³ Brian Greene, *op. cit.*, p. 392.

²⁴ Cf. Michael Heller, “Essential Tension: Mathematics-Physics-Philosophy”, in the journal *Foundation of Science* 2 (1997), pp. 44-46.

and the mathematics of the human mind, physics formulates theories whose implications extend into the field of metaphysics²⁵. Finally, if verified that symmetry principles are the foundations of the laws known in physics, then these principles could represent an even more fundamental level than particles and the fields of interaction. In such an approach, physics would be exploring a much more distant territory than those mentioned above. The end of the scientific journey might no longer be the vantage point from where one could see what determined the world to be what it is and how the world came to be this way (issues now targeted by unified theories). Rather, in these new conditions, science could focus its attention on much more challenging and broader answers, which could explain why nature observes the symmetry principles associated with the interactions we know²⁶. Science could thus aim at what lies “beneath” phenomena, deeper and more comprehensive than what current laws can capture; or something that is “behind” the powers that move the world and orders them in a particular manner. This is the ultimate “sub-layer” of reality, consisting of the most general principles that govern the physical world. By making these efforts, science probes the limits of the research applicability and capacities of its instruments and methods, somehow touching the “frontier” of the observable world. Alexei Nesteruk discerns in this the fact that science, in its design, imitated a “transcendent leap” beyond the frontiers of the world, hoping to achieve a view of the world from outside, while remaining within it, i.e. achieving a perspective that is close to the mind of God who created the Universe²⁷. Yet all these aspects do not pertain to metaphysics, but are intimately related to theology!

²⁵ Hyung S. Choi, “Science of the Unseen”, in Charles L. Harper, Jr. (editor), *Spiritual Information. 100 perspectives on science and religion*, Templeton Foundation Press, 2005, p. 157. For further insights into the dialogue between science and recent developments in physics on the issue of quantum gravity please refer to *Physics meets philosophy at the Planck scale. Contemporary theories in quantum gravity*, Craig Callender and Nick Huggett (editors), Cambridge University Press, 2004.

²⁶ Brian Greene, *op. cit.*, p. 392.

²⁷ Alexei Nesteruk, *Universul în comuniune. Către o sinteză neopatristică a teologiei și științei* [Universe as Communion Towards a Neo-

5. The comprehensibility of creation and the answers of sciences

Albert Einstein noted that perhaps the hardest part to explain, in the effort of knowing the Universe, was its intelligibility. In the same vein, the cosmologist Michael Heller, Templeton Prize Laureate, ponders²⁸: “Why is the world so comprehensible?” The successes of sciences over the last few decades have exposed an extraordinary knowledge situation: the miraculous way in which man, body and soul, encounters the created, sensitive and intelligible world, how his senses perceive the sensitive world and how his reason is able to discern in depth meanings of the world²⁹.

In many respects, the comprehensibility of the world is due to the harmony of nature. The rationality and logic of nature, which facilitated the emergence of sciences in the 17th century³⁰, have proven to be the foundations of sciences³¹. Scientific discoveries and theories reveal the entire universe as a message inscribed in light addressed to man. Moreover, when the senses or technical devices are overwhelmed by the immensity of the Universe, it opens up to us. Light rays bring the Universe down to the telescope lens, providing “evidence” of occurrences in space and time, in far flung places and times, which they experienced and where we cannot reach. The world brings

Patristic Synthesis of Theology and Science], Editura Curtea Veche, București, 2009, p. 84.

²⁸ Michael Heller, *Creative Tension. Essays on science and religion*, Templeton Foundation Press, 2003, p. 143.

²⁹ One could say that understanding occurs in a way that engages the person. When someone explains to a child what a triangle is and then asks him to repeat what he understood, they will be surprised to find out what teachers know too well. Namely that understanding is more than repeating certain content: it is about *appropriating* it. In telling what he understood, the child will speak about *his* triangle, in a personal way, adding something to what was transmitted to him. It is not a new content, but a personal way of describing it. The person who explained what the triangle is will notice a certain touch that is not his, yet which does not essentially change what he transmitted. This is the telling sign that the child understood the concept.

³⁰ Lydia Jaeger, “Cosmic order and divine order”, in *Spiritual Information*, p. 151.

³¹ Paul C. W. Davies, “The Universe. What’s the point”, in *Spiritual Information*, p. 135.

home the distant universe, where we cannot travel physically. Yet the universe also has “natural telescopes”, dense areas which curve space itself into gigantic gravitational lenses, which bring closer the images of remote galaxies, far exceeding the capacities of any man-made devices. At the other end, in the world of small dimensions, things happen in similar way. Radioactive atoms cause deep fractures in the abyss of matter which provide a view into the make-up of nuclei and illuminate a completely new field of exploration towards elementary particles and other forms of matter (anti-matter).

We have already seen that the computational cosmological model states that all objects in the Universe may be viewed as processors which communicate data in real time, in the form of radiation, about the processes and phenomena occurring inside them³². On the other hand, as radiation arrives with a delay from the different points in space, it is a “witness” of past phases of such phenomena. Overall, the computational cosmological model presents the Universe as a data flow inscribed in radiation, a flow which incorporates a considerable share of the long history of the world. Radiations constantly “tell the story” of the physical process undergone by matter and energy. Consequently, no ray of light is accidental, no residual radiation is meaningless or irrelevant, not even those emitted by the accretion disc locked in by the gravitational field of black holes. On these grounds, physics tends to prove that there is a precise meaning stored in each minuscule photon in the radiation of each star, captured from no matter where in the vast expanses of the Universe. There is a hidden meaning in each atom of each pebble, in each particle in the immensity of the physical world. Each fragment of matter contains a precious slice of the “history” of the Universe. In their own precise and concise manner, all these minute fragments are a “testimony” of the Creation we inhabit.

³² As has been noted above, light radiation constitutes a very reliable signal, although it is received *much later* and at *very great distances* from the source. Radiations, which contain very precise information, are treated in *spectrography* as genuine “autographs” from which important data about the “emitter” can be inferred.

Yet the comprehensibility of the world has another deeper source: mathematics, which human reason is able to use and whose instruments match with the order of the physical world. Not only does the universe open up to man. Man himself is endowed with senses and a penetrating reason, therefore he can perceive and describe the structures and motion of the universe. The cosmology of the past century suggests that the current description of the universe is sufficiently appropriate to cover part of its past and present and even elements of its future, because the known processes and phenomena occur according to mathematically-defined laws³³. Starting from the experimental evidence of quantum mechanics and the observational data of astrophysics, one could say that a set of properly selected formulas and signs, that could fill a single sheet of paper, are enough for an adequate description of the entire Universe³⁴. (In this specific manner, physics provides theology with a good example of the fact that the universe can be symbolically encompassed by the human mind!) Although certain recent approaches tend to refute the role of mathematics in describing the physical world, scientific fact in general, and especially the collection of data and theories of astrophysics present evidence on the capacity to encompass sensitive reality by relying on mathematical concepts³⁵.

Yet it remains inexplicable how mathematics can produce adequate descriptions of phenomena, laws and structures in the physical universe. Its effectiveness is hardly explainable so that it goes beyond the realm of rational arguments and might even be considered as “irrational”³⁶! That is why, from a scientific

³³ Kelvin Kelly, “Our universal computation, first zero, the one”, in *Spiritual Information*, p. 234.

³⁴ John D. Barrow, “Outward bound”, in *Spiritual Information*, p. 119.

³⁵ We could add a further example: electron predictions, as provided by current physics theories, have been experimentally verified to accuracy greater than one part in a billion, confirming the “astonishing agreement between abstract theoretical calculation and the real world”. Brian Greene, *op. cit.*, p. 141.

³⁶ Here we point to the so-called “irrational efficiency of mathematics”. Cf. Steven Weinberg, *op. cit.*, p. 140: “It is very strange that mathematicians are led by their sense of mathematical beauty to develop formal structures that physicists only later find useful, even where the mathematician had no such goal in mind.” (*Ibidem*).

perspective, one could say that “the miracle of the matching of mathematical language in the formulation of physical laws is extraordinary, a marvellous gift which we will never be able to understand (scientifically, our emphasis), yet one which we will also not deserve”³⁷. As Paul Davies asserted, it is impossible to be a scientist, even an atheist scientist, and not be in awe of nature’s beauty, harmony and intelligence³⁸!

6. Privileged situations in scientific fact. A theological perspective

To summarise the above considerations, two privileged situations emerge. On the one hand, one could say that, through light and everything else, the Universe approaches us and the depths of matter open up to man’s investigations and interrogations. Creation is designed in such a way as to help us to overcome our own limitations. On the other hand, one could say that we too advance in our knowledge based on the powers of reason, which proves to be admirably attuned to the world we live in. The Universe opens up to man’s eyes and reason through the physical light and man discovers it as a world suited to himself.

Yet this remarkable match between man and the world can also be observed in other areas. Physics and chemistry not only ensure man’s survival but also allow the creation of new designs and structures based on the matter existing in nature, for the benefit of his technical projects, through constantly new combinations. This agreement exists at an even deeper level. Many research situations show that man can investigate the world, looking at its phenomena and parts separately. We can have fair knowledge about certain aspects of nature while being oblivious to others. In a felicitous way, nothing relevant is lost on such roundabout routes to certain restricted segments of

³⁷*Cf.* “The unreasonable effectiveness of mathematics in the natural sciences”, Communication on pure and applied mathematics 13, 1960, pp. 1-14, *apud* Robin Collins, “Design and the designer”, in *Spiritual Information*, p. 164.

³⁸ Paul C. W. Davies, in his Templeton prize acceptance address, quoted in Joseph M. Zycinski, “Between mathematics and transcendence. The search for the spiritual dimension of scientific discovery”, in *Spiritual Information*, pp. 208-213.

reality. Quite on the contrary, this allows us to avoid complicated, intractable situations. Let us give an example of this. We can know the behaviour of an atom in terms of the chemical combinations with other atoms, without the need for data on the weak and strong interactions within its nucleus. Such nuclear “data” are simply not relevant and do not significantly impact the atom’s chemical combinations. Based on this observation, the physicist A. Zee writes that man can “learn from nature”, thanks to this favourable situation, because “physical nature must not necessarily be understood altogether!”³⁹. One could say that nature facilitates, in a way, man’s advancement, his growth in knowledge, as he passes from one phenomenon to another, from one level to another – deeper or broader, while also providing, in many cases, opportunities to verify the results of his actions. By successive steps, the world of science proposes increasingly better theories, which provide greater amounts of experimental outcomes and data, which in their turn focus deeper and on a greater number of physical phenomena.

Still, in other situations certain aspects of the world can only be unearthed in conjunction with or on the basis of others. This is the case for the discoveries made in the two vast fields of current research, the microcosm and the macrocosm, two areas which are simultaneously and mutually shaping up nowadays. Discoveries in particle physics open new avenues to the horizons of cosmology, while astrophysics observations provide numerous insights for particle physics⁴⁰.

More generally speaking, many discoveries prove that they are related to others and help to elevate man’s mind to a higher level of knowledge. The meanings of things in nature and the universe are linked to the meanings of other things or segments

³⁹ A. Zee, “Fearful symmetry: the search of beauty in modern physics”, Princeton, NJ, Princeton University Press, 1986, p. 20, *apud*. Robin A. Collins, *art. cit.*, in *Spiritual Information*, p. 164. If all of the world’s phenomena were interconnected and it could only be known by taking it together, as a whole, at the same time (a kind of three-body problem), much less in terms of knowledge about it could be achieved.

⁴⁰ Some physicists have come to believe that many more things could be discovered about the Universe by using particle accelerators rather than observing the sky. *Cf.* Geoff Brumfiel, “Welcome to the dark side”, in *Nature*, vol. 448, 19 July (2007), p. 242, p. 248.

of the world; certain discoveries shed light on others, showing that, as man comes to know and correlate them, the things and phenomena in the created world open up, like a window, to something deeper or broader. The world is somehow prepared to guide man towards broader horizons, the world's matter seems ready to guide him to its depths, while the border of the expanding universe seems to draw along man's infinite desire to march forward and comprehend the universe.

On the other hand, the elementary constituents that make up the matter in the world and scientific theories seem to reveal ever more aspects that suggest the unity of the world's distinct designs. The data collected in the world help to expand man's horizon of knowledge and to open up his mind, making it anxious to anticipate and able to receive ever deeper and illuminating answers. Consequently, whatever is discovered in the world is connected with other edifying meanings, showing that the created world is suited to the ways of man's life, through its experience and knowledge.

All of this reflects the fact that things in the created world are not randomly positioned in the environment of life, just as historical events are not scattered across time pointlessly. Neither man's life, nor the history of the world, are aimless wanderings in a life environment lacking guiding principles and symbolic value and in a time without any direction. Man is born and lives in an ordered world, where created things and their motion guide man's searches and thoughts, showing to man's mind the path towards his privileged place in the world. This path naturally leads to other, more wide-ranging questions about the meaning of all things existing and the purpose of man's life. This is another confirmation that man fulfils the purpose of the world and that existing things would be meaningless if there was no one to observe the movement of the world, who seeks and finds its answers and can progress in doing so.

Yet all of these also show that we can learn from nature, from the way it is constructed, in distinct sections, which allow successive steps. Discoveries can be arranged, one by one, in an edifice of knowledge that man can build through his life, based on what he inherited from his ancestors and on cooperation with his peers, in a sequence that continues through several generations. That the world can be known in this manner indicates that it is

similar to school: through exploration, by searching for answers about the world and themselves, people can bring solidarity among nations, mutually sharing their achievements in sciences, and constantly developing their links over time. From a theological perspective, as we share the same world and can grow in knowledge of it together, step by step, through generations, the world appears as the environment of our spiritual growth in God which we can attain by the accumulation of an ever more encompassing view about it and by living in solidarity, with our neighbours, our ancestors and our descendants. According to Dumitru Stăniloae, „Man is assisted by nature in his ascent towards God, with the purpose of growing spiritually towards God. He gathers from nature the meanings of its divine origin and uses it as a means of ever greater communion with his neighbours, who also help him to grow in communion with God, the source of the love among people”⁴¹.

Finally, scientific theories not only prove man’s compatibility with nature, but also demonstrate an unexpected affinity of physical phenomena, their mathematical description and the aesthetic space of beauty. Some of the beauty of the created world, which pleases the eyes all of us, is reflected, in particular ways, in the mathematical expressions describing physical phenomena. “Theories of physics have a certain beauty [...] the beauty of simplicity and the inescapable – the beauty of the perfect structure, the beauty of the matching rigorous logic”⁴². It is a well known fact that even without knowing precisely where in their work they should rely on their aesthetic sense, physicists have been using aesthetic judgments, in elementary particle physics. This has proven to be successful and is ever more so nowadays. They have even made decisions based on aesthetic criteria, which shows that “theories have an elegance and beauty on par with the world we experience. [...] So far, this approach has provided a powerful and insightful guide”⁴³.

Going forward, this approach to achieving results is evidence of the adequacy of the path chosen towards ever deeper and broader scientific knowledge. The beauty of the theories that underpin attempts at a more sweeping understanding of the world is not only a mere aesthetic option for the researcher, but rather the guarantee that the selected path will lead to the top⁴⁴. The

⁴¹ Cf. *Chipul nemuritor al lui Dumnezeu* [God’s Eternal Image], Editura Mitropoliei Olteniei, Craiova, 1987, p. 261.

⁴² Steven Weinberg, *op. cit.*, p. 147.

⁴³ Brian Greene, *op. cit.*, p. 187.

⁴⁴ Steven Weinberg, *op. cit.*, p. 147.

mathematical comprehensibility of the physical universe, the fact that it is amenable to accurate descriptions and the unified and beautiful intertwining of its designs are all extraordinary proof of the compatibility of the structures of matter and of the universe with mathematics, the science in which human persons who appreciate beauty are proficient.

7. Scientific discoveries and man's spiritual needs

Yet despite all this, man cannot achieve fulfilment based on answers he can find in the world, through science or his independent undertaking. From a theological standpoint, the sum of all the meanings listed so far is still not enough to enable the surfacing of the fundamental truth of faith that man is created in the image of God and that the world was created for him. Indeed, to a certain extent, based on we have presented so far we can note that the understanding and free human person, capable of love for the neighbour, is called to gather the meanings of the world and to use created objects and powers for edifying purposes. From the theological standpoint, however, man is able to do more: he can progress in this communion with the neighbours and with God. By receiving the consecrating work of grace and living in communion with God in the ecclesial environment, man can achieve God-likeness. Yet, as noted by the Romanian theologian Dumitru Stăniloae, man's likeness with God does not refer only to achieving communion with one's neighbour and with God, but equally to an "integration" of the whole Universe in the communion of the transfigured humanity. "Divine spirit", writes Stăniloae, "communicated in its completeness from Christ to the people who believe in him, strengthens their spirit and makes not only their body fully elastic and transparent, but cosmic nature itself"⁴⁵. Therefore, God transfigures the Universe, through man and with man. God makes man God-like, in proportion to man's obedience of God's commandments, but also makes the world God-like.

For all their transparency and reach, scientific discoveries on the "energetic" nature of matter or the findings about the order or unity of the physical world cannot uncover these spiritual meanings. More generally, scientific theories cannot fulfil man's life and cannot sufficiently illuminate neither the mystery deep within himself – the personal image – or the mystery within the world.

⁴⁵ Dumitru Stăniloae, *Teologie Dogmatică...*, p. 279

Viewed only as a living body, even possessing a finely tuned biology, built of elementary dual-nature energetic quanta, man still has no answer that could explain his uniqueness and profundity, the purpose of his life in the world or his spiritual needs. If it is viewed only as a collection of bio-physical-chemical, caused by an open thermodynamic system, in a world of energies, man's life cannot be connected with an equally profound logos. Judged based on the limitations of the physical world, the reason of human life cannot elucidate many unknowns, cannot embrace too many frames, cannot be anything more than a mere "accommodation to the cycle of the natural world"⁴⁶. As a result, notes the theologian Dumitru Stăniloae, man's life and knowledge end up "focusing exclusively on the natural world closed in on itself", "shaped by the nonsense, haphazard and insignificance of existence"⁴⁷.

In fact, man's desire to absorb ever more meanings, his drive to go beyond the answers found in the world towards a final, all-encompassing answer that might meaningfully connect all his life experiences and clarify mysteries, all these present man "as an intelligent being looking for meanings, capable to receive in his mind new mysteries and meanings of the Universe and of existence"⁴⁸. It appears therefore, on the one hand, that the objects and powers

⁴⁶ Dumitru Stăniloae, *Ascetică și Mistică creștină sau Teologia vieții spirituale* [Christian Asceticism and Mysticism or the Theology of Spiritual Life], Editura Casa Cărții de știință, Cluj, 1993, p. 187. Another theologian, Doru Costache, noted this issue: "viewed without a logos, and outside of the history of the Universe, the human phenomenon appears to scientific research as being 'purely natural', not the most successful product of evolution and obviously [...] accidental. In such an assessment, what matters is the chemical foundations and the game of chances, the genetic mechanism and the morphological aspects of the evolution of our species". Cf. "Logos, evoluție și finalitate. Spre o soluție transdisciplinară", [Logos, evolution and finality. Towards a transdisciplinary solution], in ICĂ, Ioan, Jr. (ed.), *Sfinții Părinți despre originile și destinul cosmosului și omului* [Views of the Church Fathers on the origins and destiny of the cosmos and man], Editura Deisis, Sibiu, 2003, p. 220.

⁴⁷ *Ibidem*.

⁴⁸ Cf. "The Dialogue among Theology, Philosophy and Science – a Necessary Path to Understanding Life". Inaugural address by His Beatitude Daniel, the Patriarch of the Romanian Orthodox Church, at the symposium «Meaning of the Universe and the Value of the Human Life – the Current Theological, Philosophical and Scientific Approach», held at the Patriarchate Palace, Bucharest, 14 May 2009. Published in the daily newspaper *Lumina*, Friday, 15 May 2009.

in the created world, man's entire space of life, are laid before him, as steps that can lift his reflection to the boundaries of the world and beyond, towards God the Creator. On the other hand, however, this also indicates that man cannot be fully satisfied with the answers found in the created world. In fact, the many limits encountered in the rational approaches to reality indicate that, based on reason alone, it is not possible even to comprehend the physical realities, even less so, therefore, to unravel much deeper mysteries, such as man's life, death or need for love. As has been said before, no matter how much we expand the fields of work of sciences, the mystery of the human person remains unexplained. That is because its impenetrable depth relates not to the miraculous make-up of the biological body or to the brain's extraordinary abilities, but to another reason, which encompasses and surpasses all of these, i.e. that the human being is created in the image of the incomprehensible God. "Then God said: Let us make man in our image, in our likeness [...] So God created man [...] The Lord God formed the man from the dust of the ground and breathed into his nostrils the breath of life, and the man became a living being" (Genesis 1:26-27, 2:7).

From the theological perspective, therefore, scientific discoveries cannot satisfy man. Fr. Dumitru Stăniloae goes deeper and unearths the deep roots of this life situation: man's questions about the self and the world cannot find answers in the world, as they are intertwined with the need for purpose and love. Even in the most comprehensive scientific theories about the universe, man cannot find anything that can fill his life with meaning and fulfil his expectations, precisely because his interrogations are much more wide-ranging, and his searches much more profound; they question the self and all of reality, death and love, the desire to understand and to live forever. In each person, Stăniloae writes, the infinite need for love is intertwined with the "indefinite wealth of meanings" and with the "unquenchable thirst to know and understand them". Yet, for man, lack of meaning does not refer only to ignorance of the meaning of existing things, but also to the absence of love. Every reason without love is a monotonous, "limited" reason, a "meaningless repetition"⁴⁹. Therefore, man's life cannot achieve perfection in the discovery of the world's

⁴⁹ Dumitru Stăniloae, *Introduction* to St. Maximus the Confessor, *Ambigua*, p. 60.

rationality and the exploitation of its resources. This is because in his search for meaning and experience of love, man does not aim for narrative answers, but for the fulfilment of existential needs, a commitment of all the power of his soul. Man aims, in fact, for a way of living, a fulfilled life.

The theologian Lars Thunberg writes, based on the considerations of St. Maximus the Confessor, that God, in His goodness, created man as a self-moving creature, in His own image⁵⁰. Yet man achieves perfection not only by moving in the world, but also by resting in God. St. Maximus maintains that “the contemplative mind, which resembles an abyss, due to natural invisibility and the depth and multitude of thoughts, after having experienced the order of visible things and arrived in the land of the intelligible and then ascended above it through the flash of the lightning of faith, will rest in itself, fixed and immobile, once it has passed all obstacles, and will invoke spiritual wisdom [...] it will ask to be given a certain understanding of faith, that could illuminate the modes and reasons of divine providence for everything that exists”⁵¹. Fr. Dumitru Stăniloae states that man’s mind, as an abyss, forever calls for the divine abyss. “It cannot be satisfied with finite, determinate things, realising that beyond every finite thing there is something that borders it. Its abyss of indefinite power cannot be filled by any number of finite things, whose sum can only be finite. Our potential abyss desires the present-day divine abyss and reaches for it”⁵².

Therefore, the conclusion of human searches, the end of his progress in the world, the answer to his answers, and the fulfilment of his needs are not gnoseological, but concern the being. They relate to the life of faith, the personal experience of the communion with God, Who loves, helps and saves him. Therefore, as saints teach us, we do not look for God in the Universe and in the energetic sublevels of matter in this world. We do not search for Him, writes theologian Dumitru Stăniloae, as „origin of the Universe, but as the aim of our life”⁵³.

⁵⁰ Lars Thunberg, *Antropologia teologică a Sfântului Maxim Mărturisitorul. Microcosmos și mediator* [The Theological Anthropology of St. Maximus the Confessor. Microcosm and Mediator], Sofia, București, 2005, p. 138.

⁵¹ St. Maximus the Confessor, *Ambigua*, & 179, *ed. cit.*, p. 517.

⁵² note 440, in *ibidem*.

⁵³ Dumitru Stăniloae, “Introducere ...”, in *ibidem*, p. 59.

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