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The Phenomenon of Emergence as a Key to Deepening the Mystery of the Cosmos, for Cross-Disciplinary and Humble Scientific Research

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Abstract: The purpose of this article is to give a historical and reasoned overview of the phenomenon of emergence according to the various authors involved, with particular emphasis on its openness to the dimension of the mystery of the real, which can lead the scientist to humility in scientific research. The evidence, the curiosity and then the study of this concept, which is so pervasive in the complexity of cosmic dynamics, in fact requires an investigation that must be extended not only to different disciplines, but through them. In fact, the cross-disciplinary method enriches the quality of this research, giving reason to both the unity and the complexity of reality. The phenomenon of emergence is particularly concerned with this cross-disciplinary scientific approach, which transcends any reductionism in favour of a network of meanings specifically nourished by the possibility of conjunctive explanations involving empirical science, philosophy, metaphysics and theology. Faced with this perspective offered by emergence, science discovers the mystery of the cosmos in a new light, thereby opening the door to an ever deeper understanding and new avenues of research. An essential characteristic of this revised scientific method, inspired by cross-disciplinarity, is thus humility, which allows, on the one hand, a deeper relationship between disciplines and persons and, on the other hand, a heightened awareness of the depth of reality, as a complex and intelligible gift of a Trinitarian God, revealed as Logos in Jesus Christ.

Keywords: emergence; mystery; cross-disciplinarity; humility; Christology; conjunctive explanations; metaphysics

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1. Introduction

The concept of emergence may appear to be a niche or highly specialised subject, but it is perhaps the most valuable 'bridge' to a truly cross-disciplinary expression of research and knowledge.

The phenomenon of emergence, based on the idea that the whole is more than the sum of its parts, concerns in fact the excess of novelty and creativity 'produced' by the reality that surrounds us, revealing the existence within it, of something more to be discovered and studied, but also opening up the fascinating complexity of the cosmos, which is increasingly beyond our full comprehension. For this reason, it has given rise to an extraordinary fruitfulness of reflections and elaborations, at the physical and metaphysical levels, which, over the years, have offered ever more stimulating possibilities for broadening the horizon of intelligibility.

The emergence of new and unexpected phenomena raises questions for the empirical sciences, and, at the same time, has a strong metaphysical appeal. Every attempt at description evades any closure or completeness and always discovers an ulteriority with ever greater force, but at the same time, with ever greater delicacy and humility, always leaving open the door to the mystery, that actually «creates the possibility of conceptual enlargement . . . in the discovery of a higher-order theory . . . mystery invites engagement, yet resists closure» (McGrath 2019, pp. 186, 201).

The concept of emergence can juxtapose the mysterious with the empirical, the infinite with the finite, the complex with the determinate and the new with the known. For this reason, it creates a constant tension in the world of research, capable of stimulating true and effective cross-disciplinarity.

This phenomenon could thus help scientific and technological progress to see reality as a network of interconnected relationships and as a window to the mystery that knocks on the door of human intelligence and challenges it.

Some important examples of emergence from different fields of application can be highlighted, not to be exhaustive, but to trace just a few results to show how rich the perspective is: in physics, the study of the origin of space-time (Bain 2013; Butterfield 2011; Crowther 2013, 2016, 2019; Hu 2009; Mattingly 2013; Wüthrich and Huggett 2018; Wüthrich 2019); the understanding of the nature of quantum correlations (Humphreys 1997, 2016; Huttemann 2005; Kronz and Tiehen 2002; Silberstein and McGeever 1999); the analysis of collective phenomena such as phase transitions (Crowther 2016; Pavarini et al. 2013; Zhang 2004). In chemistry, some examples are the study of covalent bonding (Humphreys 2016) and that of molecular macroscopic properties (Humphreys 2016; Scerri 2008). In the new and fascinating field of the science of complexity, some examples are the stigmergy and the coordinated behaviour of birds, fish and mammals (Cucker and Smale 2007; Grasse 1959; Theraulaz and Bonabeau 1999).

In each of these cases, and in many others, we encounter emergence, complexity and beauty, while along the folds of study and research, traces of a profound and unifying truth also appear. In this paper, the particular theological argument that the cosmos was created out of the Trinitarian will of Love in Christ is taken as a starting point. In this context, it is possible to speak of a 'unifying truth', in which the Word of God, at the basis of creation, determines a meaningful and consequently intelligible reality. Each perspective of research, therefore, through the plurality of disciplines involved and interacting, contributes to maintaining the realism of the sciences in the unity of knowledge. Truth is not fully evident but always leaves room for trust and appeal, so that amazement and humility in the approach to reality never cease. Trust is an essential quality in scientific research, since it places the researcher in a committed relationship with reality, gradually allowing the surprising and qualifying passage that leads from the search for 'what is the reality' to the astonishing discovery, generating new amazement and wonder, in relation to 'who is the Creator' who provides such intelligibility, offering such an involvement. The phenomenon of emergence therefore stimulates broad research, through the contribution of several disciplines that must necessarily 'learn' to articulate and dialogue with one another, possibly integrating and enriching themselves, through the recourse to conjunctive explanations. In this sense, the study of emergence favours a greater 'intelligibility' of the cosmos through the plurality of perspectives required, stimulating a deeper and more humble exploration of the mystery offered to our understanding. As A. Einstein says, «the eternal mystery of the world is its comprehensibility . . . The fact that it is comprehensible is a miracle» (Einstein 1950, pp. 61–62). The classical distinction between weak emergence (or epistemological, i.e., related only to the current or future scientific explanation) and strong emergence (or ontological, i.e., taking into account real novelties in the dynamics of the cosmos) immediately shows the wide terrain on which a variety of approaches to the problem could be grafted.

The cosmos thus gives rise to emergents that are the object of an increasingly profound and interrelated study, capable of raising physical, chemical, biological, neuroscientific, computational, cosmological, and quantum—but also philosophical and metaphysical—problems, which coherently and logically lead to an opening of the theological demand in all its facets. Whatever the ideas and approaches of individual researchers, which may or may not include theological perspectives, I believe that the study of emergence in any case requires a position in this regard, precisely because the phenomenon in question contains in itself elements of complexity that stimulate cross-disciplinary reflection. Although such openness seems 'logical', it requires that the arguments for or against a possible theological

approach be reasonably consistent and not artificially added. This research will then be all the more compelling because it will continue to provide scholars with the creative tension between the 'what' and the 'who', that has already been seen, capable of making every step of the way fruitful.

The style of this work is descriptive and offers a brief historical study of the main features of the phenomenon of emergence, highlighting on the one hand the important reference to the 'mystery' of reality and, on the other hand, a necessary appeal to the humility of the researcher. This article does not intend to enter a critical evaluation of the various problems and positions. The latter will often be cited for knowledge with direct reference to the authors, as it is not possible to deal with them systematically here. The Catholic theological perspective will be referred to in this paper, on the assumption that God's Personal Revelation in Jesus Christ has the characteristics of the Logos, that is, of intrinsic rationality and even intelligibility, that preserves the immanence of creation and the transcendence of the Creator:

> «A world created *through* the Word is essentially dialogical in character. The universe is capable of putting forth and transmitting, therefore, a meaningful content. The human person, created by God in his image and likeness, is able to recognize this meaning and decipher it. In this way, the universe becomes a privileged place for the dialogue between God and human beings; the scientist fully participates in this dialogue, perhaps frequently unaware of it, every time he or she acknowledges an objective intelligibility in nature. In the logic of research and discovery, scientists often perceive in the universe the existence of a rationality (a *logos ut ratio*, understood as reason), and at times they consider that this ordered reality is something *given*, that it is *objective* and speaking in an intelligible language (a *logos ut verbum*, understood as word), and thus making them feel attracted to the search for the truth. From a philosophical point of view, the possibility of a natural knowledge of God starting from created things has its foundation in the relationship between creation and the Word, as well as human capacity to speak (at least something) of God by making use of our knowledge of creatures». (Tanzella-Nitti 2002)

2. The Development of the Concept of Emergence

A historical 'vector' of the most important and therefore characterising reasons for the phenomenon of emergence in the initial stages of its systematic study is now resumed through various essential and constitutive concepts highlighted along the time.

The origins of the analysis of the phenomenon can be traced back to the Babylonian creation epic (Frahm 2013) *Enûma Eliš* (Talon 2005; Kämmerer and Metzler 2012; Lambert 2013, 2008; Foster 2005). In it, the question of the depth of reality was linked to terms with meanings such as art, logos, maker, matrix, life force, powerful ruler, designer and creator. The basic idea, then, was to link what we now call the 'phenomenon of emergence' to the concept of form or forms, like a forming principle, a kind of 'treasure' hidden in a reality that manifests precisely the possibilities of developing according to new models, following the 'potentials' that it might contain. This characteristic is at the heart of the phenomenon which, in its close relation and connection with the concept of form, will allow the development of a metaphysics of emergence.

The concept of emergence expressed in this way does not refer directly to creation, but rather to a disposition towards the formation of intelligible, artistic novelties, precisely linked to 'forms' in the making, starting from simple or not yet 'functioning' or defined structures. It is an emergence of forms, in a reality that can be represented as an active forge, where potentialities are contained, moving from the indefinite to the more definite along the evolution. The word also expresses the concept of a kind of energy that is constantly in motion, producing new 'animations' of the cosmos as a principle of formation. These are metaphysical features that will form the basis of all further discussions of emergence, along the lines of scientific research.

For Aristotle, the central question was related to the link between emergence and causality, trying to understand how such emergent phenomena could occur and how they could arise out of purely physical dynamics. F.D. Miller argues that «emergence [could be considered] as an interpretation of Aristotle» (Miller 1999, p. 327); in fact, it is about understanding the connection between the basic entities and the emergent ones (emergents), including the possibility of their influence on the levels from which they emerge (this will be called downward causation). This can be seen, for example, in the following expression of Aristotle's metaphysics dealing with matter in terms of opposites and the becoming of things (Gericke 2013, p. 215): «What is the cause of the unification? In all things which have a plurality of parts, and which are not a total aggregate but a whole of some sort distinct from the parts, there is some cause» (Aristotle 1924). A reference to this important concept can also be found in Plato, when he describes the words as having a 'more' than the simple sum of the letters that make them up, which is precisely their meaning: «Perhaps we ought to have said that the syllable is not the letters, but a single concept that has arisen from them, having a single form of its own, different from the letters» (Plato 1903).

The theme and question of causality is closely linked to the theme of relationality and therefore of interaction or cooperation or, better still, correlation, between entities, introducing the hypothesis of the so-called enmattered reasons (considered as 'ideas expressed in matter') (Aristotle 1935), as something that produces a kind of potentiality or unique and ultimate laws from a philosophical point of view. The 'changes' that characterise emerging novelties are also called 'emerging forms', which in turn raise the question of agents. The resulting reality therefore corresponds to a layered emergent reality with increasing levels of forms.

The concept of emergence, which deals with the idea of 'more', as a surprise with respect to the simple sum of the parts that make up a system and as an excess and therefore as a novelty, has thus been 'fuzzy and polysemous' (Gericke 2013, p. 216) from the very beginning, like a 'perennial philosophical puzzle' (Bedau 1997). The same character could be found in the contemporary discussion about it, even if it is enriched and broadened by significant scientific, philosophical, metaphysical, and theological content. It is precisely because of this broad perspective in which the study of emergence could be placed and because of its multifaceted nature that the best approach to emergence is that of cross-disciplinary research.

In modern times, the subject began to be studied in depth with British Emergentism (ca. 1874–1926), thanks to G.H. Lewes (Lewes 1874–1875), J.S. Mill (Mill 1843), A. Bain (Bain 1870), C.D. Broad (Broad 1925), C. Lloyd Morgan (Lloyd Morgan 1926, 1927, 1933) and S. Alexander (Alexander 1920). They emphasised the idea of novelties or qualitative changes that seem to escape causal addition, paving the way for a whole stream of characterisations of the phenomenon of emergence known as via negativa, with G.H. Lewes speaking of irreducibility and non-additivity of causes (i.e., that emergents are not consequences of a sum of causes from the lower levels). The expression via negativa is therefore usually used to describe what does not happen in the phenomenon itself.

Together with the non-additivity of causes, the concepts of non-deducibility and unpredictability have gradually been added, giving the problem of emergence a consistent metaphysical level that refers to substance: can one remain in monism (only one kind of substance), or must one move towards dualism, taking into account the possibility of 'new substances'? The first hypotheses of the answer, which are still current and make a more or less marked distinction, distinguish between epistemological (weak) emergence and ontological (strong) emergence, that is to say, relative and absolute emergence, respectively, the latter recalling effective and complex novelties, leading emergence itself to the metaphysical level and speaking of 'hierarchical metaphysics of emergence' (Alexander 1920, II, p. 345).

A very important conceptual result in the specific context of this paper, which is perhaps treated a little in passing elsewhere, is that of the human disposition of 'natural' or 'filial piety', of humility and of loyalty to reality, required before the phenomenon of emergence; all of them refer to the awe that the emergence of novelty naturally arouses

in the researcher, who is sometimes called upon to bow his head. Alexander's synthesis opens up a specific attitude towards the novelties of the cosmos:

> The higher quality emerges from the lower level of existence and has its roots therein, but it emerges therefrom, and it does not belong to that lower level, but constitutes its possessor a new order of existent with its special laws of behaviour. The existence of emergent qualities thus described is something to be noted, as some would say, under the compulsion of brute empirical fact, or, as I should prefer to say in less harsh terms, to be accepted with the "natural piety" of the investigator. It admits no explanation. To adopt the ancient distinction of form and matter, the kind of existent from which the new quality emerges is the 'matter' which assumes a certain complexity of configuration and to this pattern or universal corresponds the new emergent quality. (Alexander 1920, II, pp. 46–47)

It is worth noting Alexander's use of the phrase 'natural piety' in dealing with emergence, which suggests a kind of mystery in understanding the complexity of reality. Although he seems to be referring to a blind acceptance of such emergent events or effects, it nevertheless opens the door to such an ulterior dimension on the part of reality itself. In fact, it could be seen as a kind of window to the beyond, far from being truly unknowable, but as an opportunity to go deeper into investigations. On the part of the researcher, it could thus be an opportunity for humility, which is the necessary attitude for entering the realm of complexity. Lloyd Morgan also uses the same expression, referring directly to Alexander, by quoting a verse from Robert Browning's 1846 poem *Abt Vogler* about our appreciation of a musical chord: «. . . And I know not if save in this such gift be allowed to man/That out of three sounds he frames not a fourth sound, but a star. . .». From these words, Lloyd Morgan goes on to define the meaning of this 'natural piety':

> By "star" he lays poetic stress on the emergent character of "chordiness" which is something more than the additive resultant of the constituent tones—something genuinely new. If it be given in or for our hearing all we can say is: "Consider and bow the head." That in some sense should be our loyal attitude towards all emergents. As Professor Alexander puts it we must accept them one and all "with natural piety". The world has been successively enriched through the advent of vital and of conscious relations. This we must accept "with natural piety" as Mr. Alexander puts it. If it be found as somehow given it is to be taken just as we find it. But when some new kind of relatedness is supervenient (say at the level of life) the way in which the physical events which are involved run their course is different in virtue of its presence—different from what it would have been if life had been absent. If this be so on the evidence it too must be accepted with natural piety. It appears to me that on the evidence it is so. (Lloyd Morgan 1927, pp. 4, 16)

In addition to positing the difference between a mechanistic and an emergent approach, Lloyd Morgan also adds a further dimension to the idea of 'natural piety' by considering a respectful attitude that is 'loyalty':

> The essential feature of a mechanical—or, if it be preferred, a mechanistic—interpretation is that it is in terms of resultant effects only, calculable by algebraic summation. It ignores the something more that must be accepted as emergent . . . Against such a mechanical interpretation—such a mechanistic dogma—emergent evolution rises in protest. The gist of its contention is that such an interpretation is quite inadequate. Resultants there are; but there is emergence also. Under naturalistic treatment, however, the emergence, in all its ascending grades, is loyally accepted, on the evidence, with natural piety. That it cannot be mechanically interpreted in terms of resultants only, is just that for which it is our aim to contend with reiterated emphasis. (Lloyd Morgan 1927, p. 8)

The facts that 'cannot be explained' are, according to Broad, perhaps with an ironic nuance: «simply swallowed whole with that philosophical jam which Professor Alexander calls 'natural piety'» or, in the same sense, «on the emergent view, the peculiar behaviour of such systems must be 'seen to be believed'» (Broad 1925, pp. 55, 92). In the same vein, while criticising the concept of emergence, C.R. Morris says, «These events were not bound to happen, the qualities were not bound to appear. They simply happened and appeared, and their occurrence is merely to be recognised and 'accepted with filial piety'» (Russell et al. 1926, p. 49).

Whatever the real intention of the authors when they speak of 'natural piety', one can humbly dare to keep this expression without any intention of surrender, since its meaning seems to be that of a respectful attitude in the encounter with reality. Indeed, in the study of reality science appears as an exciting vocation to enter the 'emerging' mystery that gradually reveals itself.

The mystery is, in fact, an open door to the deepening and intelligibility of reality, which offers itself to be explored without the risk of presuming to possess it, with an expanded reason (i.e., a reason open to conjunctive explanations, as will be seen below) and therefore with greater freedom and effectiveness. An ability, or rather a virtue, that is required is humility, to ensure an open and impulsive attitude towards knowledge. In these first steps, humility was taken into account when speaking of 'natural piety', which, at least in such early discussions, appealed to possible 'creative' or 'ultimate' laws present in the cosmos. This approach, far from directly involving transcendence, concretely asks us at least not to forget the interest in the roots or, in a word, the need to seek the truth, as a first draft of the metaphysical search for emergence.

It is this characteristic element that reminds us of the need for a cross-disciplinary broadening of the analysis of the phenomenon, even at a 'scientific' theological level. In fact, it is a matter of reading a new, profound, complex semantics that refers to the concept of creativity with the clear characteristics of a 'transphysical emergence', because «nature is assuredly no affair of mere re-arrangements» (Lovejoy 1927, pp. 175, 180–81).

After British Emergentism, there followed the so-called intermediate period for emergence (ca. 1926–1977), which was characterised by various contributions that did not provide systematic lines of research and did not bring any substantial innovations to the study of emergence. Some of the scientists involved were J. Needhan, A.B. Novikoff, J. Huxley, S.C. Pepper, W.T. Stace, P. Henle, G. Bergmann, A. Pap, C.W. Berenda, E. Nagel and A.O. Lovejoy.

The concept of emergence then raises the problem of finality, of directionality and thus of a possible fullness. Its appeal is somehow embodied in the cosmos, to escape determinism, materialism and reductionism of any kind and to open up to a further dynamic of completion. All of these concepts are precisely constitutive of the process of understanding and attempting to explain the phenomenon of emergence, as it has been addressed in the so-called period of neo-emergentism (ca. 1977–2006), thanks to J. Margolis, K.R. Popper, R.W. Sperry, E. Morin, M.A. Bunge, D.R. Hofstadter, E.O. Wilson, H. Haken, I. Prigogine, J. Casti, M. Lissak, R.B. Laughlin, J. Holland, P. Teller, J. Fodor, M. Bedau, T. O'Connor and R. Battermann.

Neo-emergentism also adds other characteristics to the discussion, such as non-linearity, self-organisation (creative, self-generated, adaptability-seeking behaviour), beyond equilibrium (not just equilibrium), and attractors (new qualitative levels and new attractor regimes, not just final state) (Goldstein 1999, pp. 55–56).

The consequence is that it is now necessary to look for other accounts of scientific explanation or 'emergent explanations' that deal with 'hyperstructures' in new general frameworks of observation to be analysed, because «understanding a system means creating a kind of generalised resonance» (Baas and Emmeche 1997, pp. 68–69). It is worth quoting G. Spencer Brown's definition of explanation, which offers one possible aspect of the architecture of complexity, namely, the astonishing awareness of being in an inviting and intelligible realm into which mystery and humility urge us to enter:

> To explain, literally to lay out in a plane where particulars can be readily seen. Thus to place or plan in flat land, sacrificing other dimensions for the sake of appearance. Thus to expound or put out at the cost of ignoring the reality or richness of what is so put out. Thus to take a view away from its prime reality or royalty, or to gain knowledge and lose the kingdom. (Spencer-Brown 1979, p. 126)

For a systematisation of the study of the concept of emergence through its main themes, already present in nuce since the first historical analysis, various authors are then involved in the flowering of the so-called 'Re-Emergence of Emergence', which could be defined as starting with the work of P.C.W. Davies and P. Clayton in 2006 (Davies and Clayton 2006), with the rich debate nourished by many scholars, as shown by the numerous contributions included.

In this context, a good synthesis has been provided by the 'Central Dogma of Emergence', recently proposed by M. Tabaczek (Tabaczek 2019, pp. 45–61), which brings together in a new form all the main issues and themes that have appeared along the dynamic history of emergence, such as *non-additivity of causes* (cf. J.S. Mill, G.H. Lewes, J. Wilson); *novelty of complex processes, entities and properties* (S. Alexander, C.D. Broad); *emergence and supervenience*, which concerns a kind of overcoming of the purely physical level (J. Kim, P. Humphreys, H.Y. Wong); *ontology of emergent levels* (S. Alexander, C. Emmeche, S. Køppe, F. Stjernfelt, J. Kim, P. Humphreys); *emergent laws* (S. Alexander, J.S. Mill, C.D. Broad); *non-deducibility, unpredictability and irreducibility of emergents* (C.D. Broad, K. Popper, J. Kim, E. Nagel); *emergent and downward causation*, which refers to the dynamism of action exerted by the emerging levels on the underlying ones from which the former originate (S. Alexander, C. Lloyd Morgan, J. Kim, D.T. Campbell, K. Popper, R. Sperry, A. Powell, J. Dupré, M. Paolini Paoletti, F. Orilia); *weak emergence*, which considers the emergents to be scientifically explainable and says that ontological novelties are in principle not possible; and *strong emergence*, which instead supports the ontological and therefore irreducible novelty of the emergents. All these characteristics of emergence, including both weak and strong emergence, invite engagement and resist any closure in the study of the mystery of reality.

The main conceptual features that a systematic analysis of this period adds to those already elaborated are essentially that the need for a metaphysical approach to the subject has gradually become more evident. This is perhaps the most valuable result, although reductionism is always lurking, because a metaphysical dimension is essential, not least because of the re-conceptualisation of the scientific paradigm, which has led to the overcoming of the mechanistic determinism typical of the 19th century.

However, the novelty represented by the so-called 'emergents' is still negatively characterised by its features of non-deducibility, unpredictability, irreducibility and non-additivity, to which, according to some authors, inexplicability has been added, given the purely ontological dimension they assume (Kim 1999, pp. 20–22; 2006). This opens up the possibility of resorting to higher-order laws in the delicate and dynamic relationship between the parts and the whole in complex systems, as well as in the simplest reality. A fascinating and simple example concerns the properties of water compared to those of its two components, hydrogen and oxygen: «[. . .] no experimentation on oxygen and hydrogen separately, no knowledge of their laws, could have enabled us deductively to infer that they would produce water. We require a specific experiment on the two combined» (Mill 1843, I, p. 516; Lewes 1874–1875, II, p. 370). These are laws that would seem to constitute a hierarchical complexity.

In fact, there are certain types of non-material emergent features that are difficult to classify in a reductionist context, such as «concepts, information, and goals having causal effects in the material world of forces and particles, which means they have an ontological reality», showing that emergence deals with «multiple forms of existence». In philosophical terms, then, the result of emergent phenomena is 'emergentist pluralism', because many levels of reality emerge in the natural world, and the objects at the different levels have

their own 'types' of reality. What is not clear is whether true emergence is ever possible, that is, whether we have the creation of completely new types of structure and information through physical and biological processes without any kind of antecedent—the creation of a new kind of order—or whether emergence in the physical world (which undoubtedly happens) is rather the realisation of pre-existing potential and thus not a truly creative event (Ellis 2006, pp. 80–85).

The debate has also returned, from a general point of view, to the important evaluation of the substance of material reality (Lloyd Morgan 1927, p. 207; Clayton 2006a, p. 1), i.e., from a purely metaphysical side, oscillating between the monist position, which considers only one kind of substance, and the pluralist one, which instead evaluates the possibility of continuous becoming.

Although there are many nuances among the authors, and the overall differences cannot be considered as granite, all the categorisations discussed do nothing but nourish the debate, pushing it between the metaphysical level of substance and the philosophical level of causality, i.e., the relations between hierarchical levels, between laws and between the whole and the parts.

This leaves the door open, as already shown, to the possibility of multiple forms of existence (emergent pluralism), as P. Clayton affirms:

> We need multiple layers of explanatory accounts *because* the human person is a physical, biological, psychological, and (I believe also) spiritual reality, and because these aspects of its reality, though interdependent, are not mutually reducible. Call the existence of these multiple layers *ontological pluralism*, and call the need for multiple layers of explanation *explanatory pluralism*, and my thesis becomes clear: ontological pluralism begets explanatory pluralism. (Or, to put it differently: the best explanation for explanatory pluralism is ontological pluralism). (Clayton 2004, p. 148)

Analogously, on the epistemological level, we can say that this pluralism also 'emerges' from the careful analysis of the complexity of the phenomenon, adding to the reflection, the related metaphysical possibility of pre-existing potentialities.

It is a real 'metaphysical disposition' to which, paradoxically, emergence in itself refers, even in the construction of a reductionist or materialist synthesis, while exploring the depths of reality. Somehow, the 'negative' definition currently given to the phenomenon of emergence speaks of the reality of a mystery but at the same time calls for a beyond that must be woven precisely on a cross-disciplinary level.

In fact, the use of terms such as 'form' with all its declinations, 'abstraction', 'memory', 'symbolic understanding', 'feedback control', 'pluralism' and 'relational features' increasingly points to the complexity of the study of the real, emphasising that emergence is thus relational because it does not appear out of nothing but out of something else; it is not an affirmation of dualism, but a relational logical form that suggests the use of the expression 'X is emergent with respect to Y' (Humphreys 2016, pp. 27–37).

Some authors also consider a further aspect as a harbinger of possible innovation (efficacy), such as 'constitutive absence', which in this case also adds a further negative aspect to the characterisation of emergence itself: «here we are confronted with a different sense of causality, in the form of an 'affordance': a specifically constrained range of possibilities, a potential that is created by virtue of something missing» (Deacon 2006, p. 120). Deacon refers to the founder of Taoism, Lao-tzu, in the classic text *Tao Te Ching* (400 B.C.) in verse or chapter XI: «We work with the substantial, but the emptiness is what we use».

The study of the phenomenon of emergence and its dynamics can easily lead, on the one hand, to the interesting investigation of the foundations of reality and, on the other hand, to the exploration of the complex relationship ('entanglement') between (substantial) form and matter. Even the very concept of 'information', which is closely related to the theme of emergence, is, in my opinion, a fertile ground for study. In this way, it is also possible to demonstrate a tension towards metaphysics, which emerges directly and

strongly from the swarming and turmoil of the physical framework, directing and pointing out deep and crucial questions in a new 'vectorial' space of intelligibility.

3. Some Theological Perspectives about Emergence

The phenomenon of emergence, in its repercussions on practically all disciplines, truly represents a real feature of the world created as a cosmos. If, on the one hand, there is resistance to opening up the reading of reality to theological perspectives, on the other hand, it seems more necessary than ever to search for a theology that has a 'scientific' rationality in itself, so as to be able to enter into a competent dialogue with the empirical side.

This new analysis begins with the question posed by P. Clayton after describing how the logic of emergence reminds us of the idea of a reality structured with levels of organisation: «This insight leads us to ask whether there might not be yet another level, the level of spirituality and spiritual realities. Is there a level of emergent deity? Assuming there is a God, how are human being and divine being related?» (Clayton 2007, p. 681).

There are many materialistic (materialist atheism, biological naturalism, flat religious naturalism) or pantheistic (sub-pantheism, pantheism, panpsychism) positions proposed for emergence, in which a certain religious or non-religious naturalism is inscribed, depending on the emphasis.

The American biologist U. Goodenough, for example, stresses that «no miracles come from outside into the world, but the world of nature itself abounds in miracles . . . no covenant should be made with a transcendent God; instead, a covenant of silence should be made with the Mystery of life which invites to a sacred celebration» (Gregersen 2006, p. 288). In the same line (Leidenhag 2018) is also L.D. Rue, American philosopher of religion, who asserts, «whatever is natural is real, whatever real is natural . . . Naturalism rejects the notion that anything at all transcends nature, except nature itself» (Rue 2011, p. 97). This position argues that there is no need for any God in reality because, according to G.D. Kaufman, the «traditional idea of God's purposive activity in the world—a powerful movement working in and through all cosmic and historical processes—is almost impossible to reconcile with modern and postmodern thinking about evolution and history» (Kaufman 2004, p. 42). He also believes that the profound mystery of creativity requires that God no longer be seen as a person-like being but rather as a profound mystery «able to connect the enormously meaningful ancient symbol *God* with central features of our modern thinking about the origins of the cosmos, the evolution of life and other features of the cosmos, and the emergence and development of human life and culture on planet Earth» (Kaufman 2007, p. 918). Emphasising the idea of creativity, S.A. Kauffman, an American biologist, adds that God could be conceived «neither as transcendent, nor as an agent, but as the very creativity in the universe itself» (Kauffman 2007, p. 905).

Thus, emergence is basically open to evaluation in naturalistic contexts, such as the religious naturalism under consideration:

> (1) in the interpretative sphere, acknowledging the importance of philosophical and existential questions about the source and meaning of everything; (2) in the spiritual response to awe, humility, reverence, assent and transcendence to the phenomenon of existence; and (3) in the moral sphere, describing outward communal responses of care, compassion, fair-mindedness, responsibility, trust and commitment. (Tabaczek 2021, p. 146)

It offers only the conditions for «a spiritual response of reverence, gratitude, and transcendence» considered 'horizontal' but connoted with a 'covenant of silence' before the Mystery of Life in the perspective of emergence: «a way in which the universe is reenchanted each time one takes in its continuous coming into being» (Goodenough and Deacon 2006, p. 867). This position flattens out the divine in nature, as a kind of pantheism. Religious naturalism could therefore also be addressed as 'ecstatic naturalism' in the face of «awe, wonder, amazement, the appreciation of beauty, and the sense of mystery» (Clayton 2006b, p. 318).

Theological debate has also strived its utmost to propose formulations that include a possible way in which God himself participates or not in the dynamics of the cosmos, such as Atemporal Theism (Gregersen 2006, pp. 293–97) or Temporal Theism (Gregersen 2006, pp. 290–93). The second, in particular, questions the problem of possible changes and novelties also in God: it is the precious reflection proposed by various authors on the *kenosis* of God (Clayton 2007, p. 328; McCall 2010, pp. 149–50; McCall 2017, 2018).

There are three fundamental problems associated with theism: (1) that of reconciling the idea of a purely spiritual God with the material dynamism of emergence; (2) that of the directionality of emerging innovations; and (3) that of divine action, explained in the context of divine causality, i.e., God's causal intervention in natural dynamics, be it through primary causes or through secondary causes, which cannot be sustained only to justify the emergence of novelty, without foreseeing a reasonable answer to the question why in evil instead it seems that God does not intervene (problem of Theodicy).

Faced with these reflections, various authors refer to the 'Christian novelty' following interesting and certainly stimulating interpretations, sometimes slipping on the side of proposing a self-limitation of God or a kind of *hiddenness* of God himself (Rolston 2001, p. 58; Jackelén 2006, p. 624; Tanner 2006, p. 87; Simmons 1999; Creegan 2007, p. 500; Goergen 2006, p. 106). In the Pneumatological and Christological fields, an important approach to emergence could be found, which sees the Spirit as supporting the unfolding of inherent potentialities and possibilities however contained in creation (Leidenhag and Leidenhag 2015; Yong 2011, pp. 156, 158, 163; Yong 2005, p. 283). In this context, H.J. Morowitz adds that «the transition from mystery to complexity would be, in theological terms, the divine spirit» (Morowitz 2003, p. 185) and that «. . . the rule of emergence associates more closely with what theologians call the Holy Spirit» (Morowitz 2004, p. 132). While Clayton, who holds both an emergent and a pre-existing position on the Spirit, claims that

> The understanding of the Spirit is central to emergent theology . . . The divine spirit . . . must also be temporal, the emergent result of a long-term process of intimate relationship with beings in the world. In this view, then, Spirit is not a fundamental ontological category but an emergent form of complexity that living things within the world begin to manifest at a certain stage in their development. A theological corrective must be made to the 'straight emergence' view, however. The Spirit that emerges corresponds to the Spirit who was present from the beginning. (Clayton 2008, p. 110)

This opens up a whole series of problems related to the nature of God's possible intervention such as (1) vitalism (i.e., the idea of a kind of vital force or entelechy present in the reality), (2) the reduction of the Spirit in natural processes, (3) the moral problem already seen, related to the possible intervention in 'emergents' and the non-intervention in evil, and (4) the consideration of the Spirit as the generator of hierarchies and therefore also of hierarchies of injustice (however present in the world). These are all open but important problems.

The pan-en-theistic approach (i.e., the idea of considering the existence of everything in God) is perhaps the one that attracts the most fervent debate, highlighted in its various aspects by M. Tabaczek (Tabaczek 2021). This perspective certainly shows the relational dynamic, but at the same time, it leaves room for the hypothesis of an 'emerging God', raising the open problems related to the unresolved meaning of the particle 'in' and the link between transcendence and immanence: how is everything really 'in God'? What does such a relationship mean?

Another interesting contribution to this study proposes the idea of a causal influence between emergent levels, of a kind of 'flow of information' (Peacocke 2006, pp. 275–76), but this raises three important problems: scientific, because it is difficult to conceive of the 'from outside' in a universe without boundaries; philosophical, on the one hand, regarding the concept of substance in God and in creation, considering God in the world, on the other hand, regarding the causal influence without exchange of matter and energy;

and theological, in that there would be a causal levelling between the action of God and the world.

A. Peacocke, referring to the need for a pattern-forming influence (Peacocke 2006, pp. 275–76), like a flow of information available in the relational structure of the cosmos itself, expresses the need for an ontological interface between the 'space' of God and that of the cosmos.

All the attempts to deal with Divine Action thus open up an impressive debate with various possible positions on (1) the provident action of God, (2) the 'place' of the action, which for some scholars, could be the quantum one, (3) the expression of God's will and thus still (4) the problem of Theodicy.

M. Tabaczek, in his analysis of the Divine Action in an Aristotelian–Thomistic perspective, offers a description of a Dispositional Metaphysics «as a possible solution to the ontological problems of emergentism» that overcomes panentheism. The proposal describes a reading of the Divine Action in the context of a systemic causation, which «goes beyond efficient causation, reaching toward Aristotle's ideas of formal and final causes. This advice was followed by Terrence Deacon, who . . . offers a new version of EM theory, arguing in favour of a broader understanding of causation, which reaches back to Aristotelian concepts of form and teleology». This is Deacon's Dynamical Depth Model that questions the importance of the form in the sense of constitutive absence or formative absence (again, negative aspects in the definition of the phenomenon) and of constraints as engines, considered as formative constraints, as specific unrealized potentials. This reading addresses the need for a consistent metaphysical interpretation of reality, which Tabaczek offers precisely by adding a Dispositional Metaphysics. The latter describes a reality that is ontologically composed of dispositions or powers that manifest themselves through causality, in a context of structural relationality (causal connections). The Divine Action, expressed by the four Aristotelian causes in the Thomistic elaboration, sees God's being and action as intimately connected (Tabaczek 2019, pp. 35–36; 2021).

4. Discussion in the Context of Conjunctive Explanations

The 'territories' explored by the study of emergence explicitly require the following methodological approach and research disposition with regard to the stimulating contemporary debate on the topic of *Conjunctive Explanations in Science and Religion* (Finnegan et al. 2023; Glas and de Ridder 2018) in order to meaningfully combine different disciplines. This method implies, on the one hand, the need to open up beyond the system being directly analysed, in order to re-enter it with new and broader epistemological categories and, on the other hand, the importance of a systematic structuring of both scientific and theological arguments that can contribute to its understanding (Peacocke 1996, p. 24). Indeed, the fundamental problem of scientific research concerns the involvement of the 'observer' in the 'observed': «our research methods actually *limit* what we can know, in that we do not observe nature itself, but nature as it is disclosed to us by our research methods» (McGrath 2023, p. 296), as Werner Heisenberg's research emphasises (Heisenberg 2007, p. 85).

The openness to a meta-system that is broader and includes the system in question, or a meta-language, to quote Wittgenstein, in order to penetrate the depths of reality, invites us to the double 'scientific exercise' of diastole (opening up to multiple levels and broader horizons) and systole (studying the phenomena), in order not to run the risk of reductionism (Palacios 2022; Gillett 2018), let alone physicalism (i.e., considering everything as only physical). A valuable consequence of this approach is the need to provide a framework for exploring conceptual issues arising from scientific research, in order to effectively integrate multiple and conjunctive explanations (Glass 2023, p. 19).

Given the progress of contemporary science, the term 'science' itself needs to be well understood, since we can no longer speak simply of '*the* scientific method', because, even in the face of a certain ontological unity, we must admit the need for epistemological pluralism (Rose 2004, pp. 128–29). Indeed, the complexity of reality suggests a plurality of explanations and understandings, since «we can understand more than we can explain . . .

we can explain more than we can understand» (Williams 2023, p. 272) as the phenomenon of emergence shows us in a privileged way. As a result, one can enter reality, precisely in its complexity, with an attitude that is at once humble in the face of its mystery and passionate in the face of its depth. As G.K. Chesterton reminds us, by allowing «one thing to be mysterious . . . everything else becomes clear» (Chesterton 1995, p. 33), thus opening up a new horizon of understanding, free from the confines of reductionism and open to what A. McGrath calls 'an explanatory mosaic'.

In fact, the simple recourse to Ockham's razor no longer seems to be a method that can be applied tout court and «the 'without necessity' clause ("plurality cannot be posited without necessity") must therefore be taken very seriously» (van den Brink 2023, p. 225), because reality seems to require the interaction of different epistemological levels in order to provide conjunctive explanations.

A complex and fluid explanatory matrix is now necessary for methodological pluralism, precisely in order to 'bridge disciplinary divisions', because «to understand something is to locate it within a web of meaning» (McGrath 2019, p. 145; 2023, pp. 299, 302–305). This is, indeed, the meaning of an 'explanatory mosaic' in which appropriate 'bridging theories' (Kruglanski 2008) are studied for a more comprehensive explanatory account while seeking a framework or horizon in which to compose a 'web of meaning' required by the reality itself.

Indeed, the complexity of the real demands that we should be able to say, even from the empirical sciences, that the process of explication is also metaphysical: «"there is good reason to believe that scientifically possible questions should be expected to receive scientifically statable answers," but the very existence of the domain of science requires an explanation that cannot be given in scientific terms. "Physics needs metaphysics for its intellectually satisfying completion." In fact, although scientists "officially foreswear metaphysics, covertly they love it"» (Williams 2023, p. 274). It is science itself that demands plurality: «Science asks metaphysical questions, and relies entirely on metaphysical assumptions about the presence of scientific laws, thus the boundary between the scientific and the metaphysical is not always clear» (Brown 2023, p. 252).

It is precisely the constant metaphysical call of contemporary science that generates, on the one hand, a growing astonishment and, on the other, a new method of investigation in the broad spectrum of human knowledge:

> Conjunctive approaches to explanation, however, when deployed in a scientific context, enable specific disciplines to engage in constructive and productive dialogue with others, leading to an enriched explanatory rendering of our world. We are no longer engaged in a debate about which explanation is right; the question is how distinct disciplinary explanations can be woven together, allowing a deeper and richer understanding of our complex world. (McGrath 2023, p. 296)

The key, then, is to follow the paths of an explanatory role for theology, up to and including metaphysics. In fact, «the explanatory gain out-weights the explanatory cost that is incurred by theism or Trinitarianism, in that the introduction of God does not add an additional item to the fabric of the universe that requires to be explained (and thus add to the explanatory cost), but rather makes available new explanatory capacities and resources» (McGrath 2023, p. 301), precisely according to the novelty of the Personal Revelation of God.

The theological debate remains open to and very fruitful for so many stimulating contributions, with the epistemological investigation offered by the study of the Incarnation of the Divine Logos in Jesus Christ, with his hypostatic union between man and God 'without confusion' (the unity of human and divine nature as an actual and concrete existence or hypostasis or person: Council of Chalcedon (451). The latter is the only concrete and reasonable way we have so far to reconcile immanence and transcendence from a theological, metaphysical and physical point of view.

The vision proposed is one in which it is recognised that

> the metaphysical explanation which science requires takes a religious form and the religious form takes a theistic form . . . theism is the best explanation for the world which science probes and describes, and anyone who pursues rigorous enquiry into evidence for the truth of the central Christian claims about Jesus, doing so with all the spiritual ardour and intellectual reasonableness of the *bona fide* scientist, will alight on Christianity, in particular, as the form of religious and theistic belief which is intellectually most satisfying and coherent. (Williams 2023, p. 275)

Indeed, «"the moment the question of God is acknowledged to be legitimate, the clarification of metaphysical options becomes imperative" . . . If theology "is the great integrative discipline . . . metaphysics practised in the presence of God," we need a theology of divine presence to accompany an intellectual insistence on metaphysical explanation» (Williams 2023, p. 278). Thus, «Christianity offers primarily, yet not exclusively, an epistemic model of explanation, by throwing a conceptual net over the complexities of experience, so that these may both be captured and colligated» (McGrath 2019, p. 145).

In particular, it is legitimate to acknowledge that «Trinitarian theism is the apex of "Explanation" . . . the doctrine of the Trinity is the consummation of a deep scientific quest, not simply an achievement in the isolated domain of theology» (Williams 2023, pp. 275–76).

5. Discussion in a Christological Perspective about the Mystery of Reality

The study of the phenomenon of emergence is thus a privileged territory for human reason (McGrath 2019) to seek and find a 'grounding' which could be represented as «a metaphysical link between *explanans* and *explanandum* across levels, rather than across time. . . . Grounding is something like metaphysical causation. Roughly speaking, just as causation links the world across time, grounding links the world across levels. Grounding connects the more fundamental to the less fundamental, and, thereby backs a certain form of explanation» (Leidenhag 2023, p. 128).

In his famous book *Passer le Rubicon*, Emmanuel Falque opens up and nurtures the challenge of thinking in the search of truth, extending it to the dimensions of a new cross-disciplinary perspective that has its roots in medieval thought and that could find various developments in contemporary research. In his first and essential synthesis, Falque speaks of the conversion of philosophy by theology, thanks to the opening of the horizon of finitude revealed by the Incarnation of Jesus Christ. The result is the birth of a new possible 'discourse on method', along the interconnected levels of an active and fruitful philosophical, theological, and scientific cross-disciplinarity. One of the crucial points in this real 'crossing of the Rubicon' is the consideration of finitude, of contingency, which could be renewed as no longer the prerogative of philosophy alone but could and must also be welcomed with wisdom by theology, in the face of the Incarnation and the Resurrection, in its important way of being positive, for which a completely new horizon of finitude opens up. It is precisely this characteristic of human existence that is fully assumed and transformed by God in his Incarnation (Falque 2017, pp. 30, 152–53).

As Falque suggests, it is a question of going beyond the overcoming, of preferring the 'passage' rather than the 'leap', and therefore, the role of a rediscovered metaphysics will no longer be that of being only 'after physics', nor 'beyond' it in an ontological sense, but will be considered in the experiential sense of the 'passage' and of the 'crossing', understood analogously as 'passio' and 'patio': Metaphysics as a 'dramatic' act of crossing the physis, meta (trans) physica. It is about «"to suffer" and "to pass" through finitude and the world (philosophy), 'to pass' and 'pass it on' to another, God the Father, able to carry it and support it with me (theology). Suffering and passing through, consecrate the *physis* as the anchorage *par excellence* of thought, whether it be philosophical (the horizon of the world) or theological (its "metamorphosis" in the Resurrection)» (Falque 2017, p. 162).

Indeed, there is a need for a new opportunity for contemporary research to read reality in its complexity, but without losing its deep and precious cross-relations in the bold challenge of crossing the Rubicon of finitude. The challenge is to rediscover a reality that

is both multi-dimensional and unitary, available and intelligible, complex and dynamic, plural and unified, and creative and informational, as the phenomenon of emergence invites us to do.

This approach requires what some scholars call *contuition*, which is not a simple and 'solitary' intuition, but a perception of God from another object, revealing a relational, enriched and dynamic approach to the study of reality (Sciamannini 1957). All these indications lead to the confirmation of a theological charge that is fundamentally contained in all created beings, where the Incarnation is the space of encounter with the divine Mystery, as a meaningful vectoriality: «creatural reality has an inner dynamism that allows us to contemplate in the epistemological ascent of creatural evolution (*by*), insofar as God manifests Himself presentially as existing in the inner dynamism of creatural evolution (*in*)» (Lázaro Pulido 2018, p. 276).

In fact, «nature thus signified can, from its own *quiddity*, create new spaces and point to a geometry of infinity, in which the idea of perfection, and not only of complexity, can come into play». Reality is then dynamic in its intimate structure, oriented towards that *quidditative* depth, that the study of emergence makes us face:

> Nature thus signified can from its quiddity create new spaces and point to a geometry of infinity, in which the idea of perfection, and not only of complexity, can come into play…. Reality appears as a score (méthexis) which has to be known with the eye of the understanding and which is called to be sung (mimesis) in its affective meaning, so that not only the science of a theologian is needed to read the notes and their relationships, but also the wisdom of the minstrel born of feeling, affection and will to grasp and interpret the spirit of the score and to be able to grasp the reality that transcends the (phenomenal) notes. (Lázaro Pulido 2018, p. 277)

The latter is constantly involved in relational operations throughout evolution, without confusion between phenomenal and noumenal reality:

> Both in the process and in their intimacy (of *significatio* and *quidditas*), created realities are constituted in visible moments of their seminal roots (now already contemplated in the *descentio* to which thought has access after cointuition). … natural reality considered in its signification is not presented as an analogy of God, but as an expressive sacrament (sign-*for* and symbol-*in*); it does not appear as a rational understanding, but as a spiritual and psychological intimacy (the soul). Finally, it does not confuse planes, but opens ways of access with an ontological charge that frees from an empty analyticism …, from a deceptive realism …, from a psychological phenomenology …, and from a transcendent aesthetics (from the cointuition of being to the good). Reason gives way to affectivity, order becomes beauty. And curiously, the end is itself dynamic (intratrinitarian), for it is in knowing the One that we see its intimacy and nature as Triune. (Lázaro Pulido 2018, p. 278)

In this context, it is then possible to explore how the different levels of reality constantly interact, according to a relationality that is intrinsic to creation and that constantly challenges, in an analogical (non-digital) and non-univocal way, its intelligibility which offers itself as a vocation to man who immerses himself in it, thirsting for truth.

The profound nature of creation is intelligible in the horizon of the extraordinary novelty, challenge and constant source of mystery, knowledge and love, represented by the trinomial Incarnation–Cross–Resurrection. This perspective offers a revealed and therefore unexpected opportunity to know the matter of the universe in its structure, also from a theological approach, capable of founding a solid and symphonic metaphysics that could illuminate science. In Jesus Christ, real man and real God without confusion, it is possible to develop a new consistent reasoning while studying science, capable of crossing the horizon of finitude between theology, metaphysics and physics, for a better understanding of the emergent complexity of the cosmos. In this sense, the reality of the cosmos could

obviously be conceived as not complete in itself, but constantly tending towards perfection, in a non-random but directed evolutionary process (Nardello 2018). It can therefore be argued that Christology with the logic of the Incarnation—thanks precisely to the definition of Chalcedon, which places in Christ the presence of both the human and the divine natures without confusion—is the most favourable key for interpreting the dynamics of the cosmos. In particular, as has already been pointed out, the novelty of the Incarnation can be the only way that allows and guarantees conjunctive explanations involving the empirical sciences, metaphysics and theology, in a sustainable and well-founded way; the Incarnation, in fact, guarantees and sustains the possibility of uniting explanations, even if placed at different epistemological levels, but converging on the same created reality, without incurring aporias or compromises in the 'management' of both creation and the divine.

According to a cross-disciplinary reading of the complexity of the created cosmos, in its extraordinary anti-entropic tension, in which life, and especially human life, is expressed through non-linear, dissipative and out-of-equilibrium complex systems, the extremely rich creativity of the universe is manifested through the dynamic process of evolution, which, according to Christian theology, aims at the fulfilment of creation. I would also see the phenomenon of emergence as a dynamic and continuous anti-entropic relational dynamic in which all creation participates. It could be conceived as a kind of anti-entropic force for human intellect and human unity: for human intellect, because it challenges reason, not only with regard to the intelligibility of creation, but as a new step in the understanding of its dynamism, and for human unity, because it helps to grasp the whole sense, meaning and end (in the sense of finality) of life. Indeed, emergence, with this anti-entropic evidence, with its intrinsic, dynamic and bidirectional (downward and upward) interconnections, and with its systemic, unified structure, seems to capture our intellect, proposing, on the one hand, an integral view that combines origins with eschatology and, on the other hand, a synthesis of science, metaphysics and theology. Emergence could thus be recognised as an important field of discussion, offering the possibility of disclosing science, of freeing its intrinsic longing and of discovering and welcoming its determinant extension, which is theology, thanks to the common and complementary characteristics of being revealed, and therefore rational, intelligible and scientific:

> Science must be open, even multifaceted, without therefore fearing the loss of a unitary orientation. This is given by the trinomial of personal reason, freedom and Truth, in which the multiplicity of concrete implementations is founded and confirmed. I have no hesitation in placing even the science of faith within the horizon of a rationality thus understood. (John Paul II 1980, n. 5)

In this way, it is possible to express a dynamic and inclusive cross-disciplinary scientific research, while maintaining the two pillars of scientific knowledge: the humility of the researcher and the mystery of the cosmos. In this respect, the Pauline expression is paradigmatic and inspiring: «May have strength to comprehend with all the holy ones what is the breadth and length and height and depth» (Eph 3:18), which moves towards the fourth dimension of 'depth' (βάθος), capable of characterising complexity and emergent phenomena. In line with this strategy of investigation and research, the following verse (Eph 3:19), on the one hand, aims to connote this expanded knowledge and, on the other hand, offers illumination for the possibility of a deeper intelligibility that unites Truth and Charity (Veritas and Caritas): «And to know the love of Christ that surpasses knowledge, so that you may be filled with all the fullness of God». In fact, «The reason of the world allows us to recognize God's reason, and the Bible is and remains the true Enlightenment which entrusted the world to reason and not to the exploitation of man because it opened reason to the truth and to the love of God. For this, we do not need to hide our faith in Creation even today. We can't hide it» (Ratzinger 2006, pp. 33–34).

6. Conclusions

The mystery of the emergent novelties and of 'ordered' organisations, even within the physical and cosmological process characterised by a constant increase in entropy, surprisingly proposes and reveals an internal and intrinsic 'anti-entropic' tension. The latter, which naturally avoids reductionism, activates several epistemological dynamics that pull and drop and constrain and expand scientific, philosophical, metaphysical and theological arguments that overcome both the limits of (1) claiming too much autonomy that cannot be attributed to such a complex reality and (2) going too far in improbable and unrealistic concordances.

The appeal of the now-fascinating and ubiquitous evidence for this phenomenon responds to the need to delve more deeply into the metaphysical but also necessarily theological foundations of creation.

In this work, an overview of the state of the art on the phenomenon of emergence has been proposed in order to highlight the main and determinant concepts with their crucial hinges and interconnections, demonstrating both the value of the mystery as an invitation to cross-disciplinary intelligibility and the call to humility along the path of the new scientific research.

The unexpected and fruitful richness of this fascinating and complex debate could blossom precisely in the possibility of studying the Personal Revelation of God in Jesus Christ, as a qualifying epistemological value added to the human one. In fact, it is a true 'theological singularity' (Incarnation, Cross and Resurrection of Jesus, the Word of God) or, in other words, a resolutive 'breaking of symmetry' that has occurred in the cosmos, which could be the unique 'information' capable of guaranteeing its metaphysics and its intrinsic principle of unity between God and the human person, in the surprising logic of the hypostatic union, 'without confusion' in Jesus.

It is then finally and reasonably possible to combine metaphysics and theology, to 'scientifically' intercept the questions that come from the empirical sciences, recognising that theology thus connoted is also scientifically acceptable as an extension for the study of emergence.

The phenomenon of emergence could therefore be seen as a reflection of the mystery of the cosmos and the mystery of the un-graspability and unavailability of reality which, although accessible, nevertheless escapes deterministic possession and full demonstrability but not intelligibility and truth. Intelligibility is at a different and further level from demonstrability, because it involves more interrelated epistemological contributions of reason. Rather, it opens up new horizons each time, inviting the researcher to further insights and challenges, including above all the theological reading of the universe, at higher and deeper levels.

Emergence pushes our efforts to understand the cosmos in the direction of an unexpected and tidy exit towards the mysterious beyond simple reason (logos), along the paths of a surprisingly anti-entropic dynamism, to be necessarily faced with humility, together with Jesus Christ, the Personal Logos.

The conclusion, then, is an opening to further possible analyses, both to offer new elements and to integrate them in a fruitful, deeper and humble understanding of the mystery of the cosmos as a revelation of God the Trinity.

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