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Energy or Information?*

Abstract

The descriptions of the development of events in nature from the moment of the Big Bang are using concepts of 'energy' and 'matter'. Systemically, these descriptions lack the third component of every system – information. This brings up the question of where in these descriptions information is and does it possibly precede energy. The analysis used the general systems theory, one of the powerful methods in modern science. For the description of the general technology (natural and artificial technology), from the Big Bang to the final point (a state of complete rest), we used our own concept based on two thoughts: the technology is nothing special but quite general (O. Spengler) and the fractal concept of Nature (M. Deege). It was found that the descriptions lack the answers to the question of the origin of information system whose activity began with the Big Bang. That information input is divided into command and data. With the help of philosophical knowledge, including Plato, Aristotle and Thomas Aquinas, it was concluded that someone had to make the natural laws that are transmitted in the form of information into energy during the Big Bang before inflation and the creation of matter. The question of who ordered the construction of the laws of nature and started the Big Bang is especially important. This article does not state explicitly who gave the order for the making and who made the transmitted information.

Key words

Big Bang, energy, information, matter, general systems theory, concept of fractal past and future of general technology, natural technology, artificial technology

Introduction

The systems theory is among the most powerful scientific methodologies and we have so far used it in various research attempts, such as injection moulding of living and non-living substances,¹ the analysis of Croatian language,² comparison of Plato's *ideal* state and human body³ etc. The theory deals with three basic concepts: energy, information and matter. The concept of general

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¹ Čatić, I., Rujnić-Sokele, M.: "The Systemic Analysis of Injection Moulding", *Polimeri* 47 (2001), p. 15–21.

² Čatić, I., Šarić, Lj.: "Prilog sustavnoj analizi hrvatskog jezika" (Systemic Analysis of Croatian Language), *Rasprave Zavoda za hrvatski jezik* 20 (1994), p. 19–30.

³ Čatić, I.: "Kulturološki-sustavna raččamba Petrićeva *Sretna grada*" (Culturological-Systemic Analysis of Petrić's *Happy Town*), *Zbornik radova VI. međunarodnog filozofskog simpozija Dani Frane Petrića*, Cres, 13–17 July 1997, Hrvatsko filozofsko društvo, Zagreb 1999., pp. 333–352.

technology (encompassing both natural and artificial technology)⁴ has been developed, spanning from the *Big Bang* to Zeptotechnology with an open end. The most widespread opinion is that energy preceded matter, but it still remains unclear whether the emergence of information preceded energy or *vice versa*. We have employed the systems theory methodology in order to analyze the zero point in the *Big Bang* as a technical system, via notions of input/output as well as the states of information, energy and matter. There are two sub-inputs within the information input, order and data. What we have assumed is that order precedes data, which implies the primordality of information.

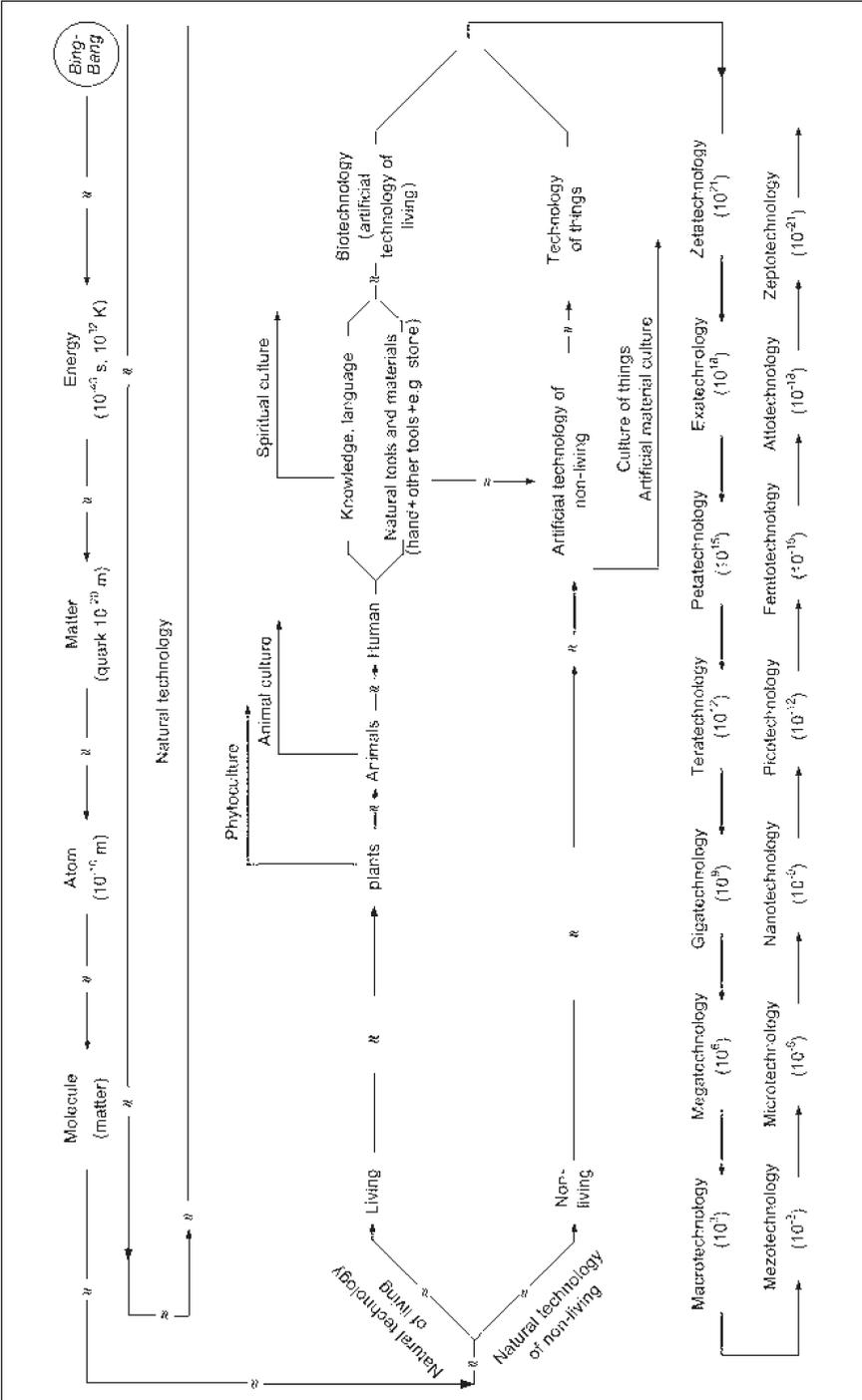


Figure 1. From Big Bang to Zeptotechnology (creative spark, unpublished version, 2010).

From *Big-Bang* to Zeptotechnology

The systems theory methodology has been applied in polymer processing for about forty years,⁵ after which it was extended to studying some other production processes, as well as to language, social systems, organization etc. The ideas derived from *Fractology of Technology*⁶ have served as an inspiration for the development of the concept of general technology,⁷ which includes both natural and artificial technology. Our research extends from the *Big Bang* to Zeptotechnology with open end, or otherwise from *initial* and *final* point (Fig. 1⁸).

In developing the concept of general technology,⁹ starting with the *Big Bang* and finishing with Zeptotechnology, three basic ideas were used. The first stems from cybernetics and claims that all phenomena in the Universe can be described as energy, matter or information. The second idea finds its origin in the words of Anthony G. Oettinger, who claimed that “without matter, there is nothing, without energy, nothing happens, without information, nothing makes sense”.¹⁰ It is precisely because of that important to determine the order in which these phenomena came to exist. And the third idea is possible *final point* in this concept. The state of *initial point* represented by the *Big Bang* is chaos. The final point must be than the state of zero entropy, the system must be at absolute rest.

An idea that energy preceded matter presents no problem, which is not the case with the emergence of information, for which it remains unclear whether it preceded energy or it was the other way round. Some scientists give priority to energy, and some to information, but hardly any arguments get to be provided in support. Thus, our decision was to try to answer this question by using the laws of systems theory in order to analyze the zero point in the *Big Bang* as a technical system, described by the already mentioned notions of information, energy and matter in both their inputs/outputs and states (Fig. 2).

⁴ Čatić, I.: “Zašto je moguć korjenit razvoj materijala a samo inovativni proizvodnih postupaka i proizvoda?” (Why is the Revolutionary Development possible in Materials and Only Innovative Transformation in Production Procedures and Products?), *Polimeri* 24 (2003), p. 64–73,

⁵ Čatić, I.: “Einführung in die Systemanalyse beim Spritzgießen” (Introduction into systemic analysis of injection moulding), lecture, Institut für Kunststoffverarbeitung, Aachen, June 20th, 1969.

⁶ Deege, M.: “Fraktologija tehnike” (Fractology of Technology), *Filozofska istraživanja* 18 (1998), pp. 963–973.

⁷ Čatić, I.: “Zašto je moguć korjenit razvoj materijala a samo inovativni proizvodnih postupaka i proizvoda?” (Why is the Revolutionary Development possible in Materials and Only Innovative Transformation in Pro-

duction Procedures and Products?), *Polimeri* 24 (2003), p. 64–73,

⁸ From Deege, M.: “Fraktologija tehnike” (Fractology of Technology).

⁹ Čatić, I.: “Zašto je moguć korjenit razvoj materijala a samo inovativni proizvodnih postupaka i proizvoda?” (Why is the Revolutionary Development possible in Materials and Only Innovative Transformation in Production Procedures and Products?).

¹⁰ Oettinger, A.G.: “Knowledge Innovations: The Endless Adventure”. This talk has been edited from the notes for Dr. Oettinger’s keynote address to the *2000 Annual Meeting of the American Society for Information Science and Technology: Knowledge Innovations: Celebrating Our Heritage, Designing Our Future*.

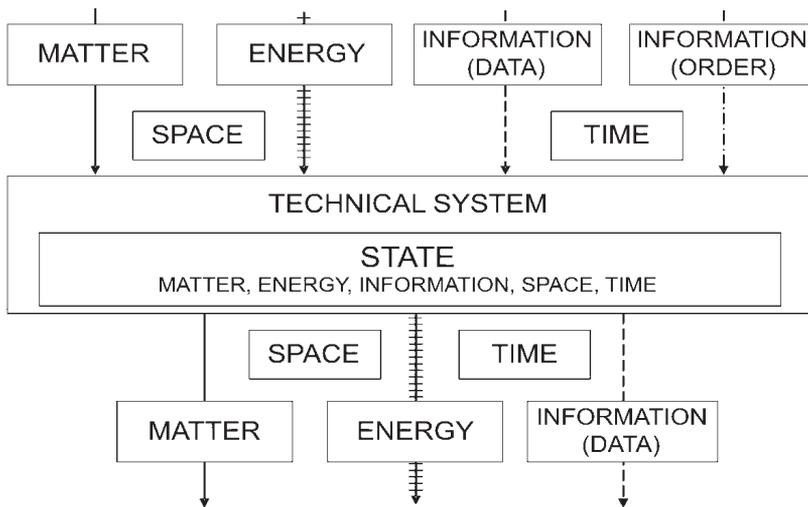


Figure 2. Block scheme of technical systems (G. Ropohl¹¹).

Figure 2 thus implies that there are two sub-inputs within the information input in the system: order and data. Our assumption is that the sub-input *order* must precede the sub-input *data*, which is the basis for the conclusion arising from systems analysis, information came as first.

The Metaphysical Approach

The analysis of the issue from the metaphysical standpoint leads to the same conclusion. The question of the origin of the Universe has troubled metaphysicists throughout history, its crucial research question always being the same: what or who was the first in the process of the creation of the Universe, regardless of whether the Universe itself is considered, or the Universe in its current state of perfection, i.e. completion. The research of the latter, namely, always necessarily directs to the former, or in other words, to the question of the first principle or *arche*, as Anaximander called it.¹² It is in this sense also that the information-energy priority issue enters the field of metaphysical research.

The first among the great philosophers, such as Plato and Aristotle, considered that priority resided in form, which is the first principle of existence, creation and cognition.¹³ A great contemporary expert on Aristotle, W. Jaeger, thinks that it is precisely Aristotle's teaching on form that is his greatest contribution to the Western culture.¹⁴ It is therefore necessary to point out here that form is the carrier of entire evolution and change, not the change as Heraclitus speaks of it, but rather the change as the transition from the possibility of having a certain form (matter and energy) to actually possessing it (information). Therefore, form is the active metaphysical principle in the being, while matter is the passive one. The mentioned transition can be achieved only by the one actually possessing the form, at first as its own form, and then also as the purpose of its action. Thus, form is the initial and the final of the perfection in every being and the entire Universe.¹⁵ It was precisely due to this discovery, with the development of metaphysics in the Middle Ages, that form is the absolute essence-bearer for every being (*forma dat esse*).

Thomas Aquinas provides even stronger arguments supporting the form-priority thesis as well as the perception of the nature of form, i.e. of its role in the

creation of all beings from the first principle. He states more than once that form bears essence (*esse*) to a real individual being.¹⁶ However, unlike his predecessors, Thomas Aquinas provides a deeper metaphysical insight into form, which was of great help to us and gradually led us to answer the final question that will conclude this paper of ours. Aquinas does not, however, take the above statements to imply that form causes essence in the actually existing matter, but talks of formal causing whereby form determines the essence of things only at the formal level (determines the things to be what they are), but not at the level of existence.

In the radical sense, the existence provides things with their acts of existence (*actus essendi*), which they gain by participating in the very Essence (*Ipsum Esse Subsistens*). In a similar way, the form determines our cognitive abilities. It bears essence to a complex real being, while what actually causes essence presents the first absolute principle of the world. Whoever or whatever it is, it must most authentically possess essence, since it can as such be the source of all essence and all forms in the Universe.

Since human knowledge is nothing more than the reception of real matter forms in an intentional way, information in fact represents the analogue way of the existence of forms.

Causality or Motivation? The Development With or Without Purpose?¹⁷

The concept of the beginning of time is often identified with the term ‘Big Bang’ in order to be able to answer the question of what there was in the beginning. However, the phrase “the beginning of time” conveys a wrong linguistic impression, because certain space or resonant basis already needs to exist in order for the bang to take place. Contrary to that, the aforementioned expression is often wrongly used to refer to the spreading of the not-closely-determined “something” to the energy in space, time and matter, which is possible only with the help of prior transcendent “information” manifested as a free absolute order or command – “Let there be...!” This primeval energy (*Big Bang*) appears as *causa*, and not as *causa prima* but as *causa secunda*, with its further spreading being manifested only in the causal chain, whereby it remains

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Ropohl, G.: *Eine Systemtheorie der Technik: Zur Grundlegung der Allgemeinen Technologie* (A System Theory of Technology: Towards the Foundation of General Technology), Carl Hanser Verlag, München 1979.

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Anaksimandar: “Fragmenti” (Anaximander: “Fragments”), in: Diels, H.: *Predokratovci* (*The Fragments of the Presocratics*), Vol. 1, Naprijed, Zagreb 1983.

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These two great ancient philosophers differ only in the question of how form is present in the real sensory matter. For Plato, the forms of sensory matters are only participating in real forms or Ideas that are transcendent and non-material. On the contrary, according to Aristotle, form is a constitutive metaphysical principle of all matter and is really present in

it. Therefore he proclaims it to be the most excellent cause of matter and species. Aristotle: *Phys.*, III,3, 194 b26; *Met.*, V,2, 1013b23.

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Jaeger, W.: *Aristoteles – Grundlegung einer Geschichte seiner Entwicklung*, Weidmann, Berlin 1923.

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Aristotle: *De Anima*, II,1, 412a10; *Met.*, V,4, 1015a10.

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Thomas Aquinas: *In V Metaph.*, 1. 2, n. 775; *S. Th.*, I, q. 54; *In I Sent.*, d. 26, q. 1, a. 6, ad. 2; *De princ. naturae*, I, n. 34a; *In I De caelo*, 1.6, n. 62.

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Davies, P.: *Peto čudo: potraga za podrijetlom života* (The Fifth Miracle), Izvori, Zagreb 2001.

impossible to fully predict its consequences. This is to say its causal power is limited, as it cannot be identified with *causa finalis*, but only with *causa agens* (active cause), which is connected to both *causa materialis* and *formalis*.

Just as biochemist Friedrich Cramer (Göttingen) showed via chaos theory, the notion of temporal development implies irreversibility. Everything that is truly *new* in natural processes cannot be predicted and appears only in chaotically intertwined ramification, as is the case with e.g. flashes, waves, wind, but also with the evolution of family tree, and with the growth of plants, animals and humans. The spread of all these cannot be calculated in advance. It can retrospectively be brought down to a single *causa* or to many reasons, but cannot be determined ahead of time. From this point of view, long-term physical, chemical or biological processes should be considered as subject to chance, their purpose being unpredictable and their development describable and explicable only *a posteriori*.

Unlike this, the concept of being (*creatura*), which refers to the reality shown by Figure 1, establishes a timeless principle that is constantly being fulfilled. That is to say that there is a purpose to creation or, to put it philosophically, *causa efficiens* (active cause) cannot be thought or imagined without *causa finalis*. The question *to what purpose* is a consequence of the question *why*. If the question *to what purpose* is abolished, natural processes become senseless. Simply because it is impossible to think of a creation without the Creator, or of an order (information) without thinking of the one who issued it.

What will now be additionally given are some theological interpretations. One of the oldest accounts of creation is the Biblical one (Gen.1:3), cited below together with the author's comments in parentheses.

“And God said (*ordered*), let there be light (*energy*): and there was light (*production of electromagnetic energy*). And God saw the light, that it was good (*quality assurance*).”

This would imply the precedence of information. Also P. Davies makes a point that can be understood in this sense, when he says that the key to discovering the beginning of life – a big mystery not yet solved by science, can be found in information. For him, the spark of life has to do with organized information, and resembles a computer process.¹⁸ V. Paar participates in the debate as well when he states that determining whether information or energy hold the precedence is a philosophical question.¹⁹

In his profound and comprehensive study *Creazione*, distinguished theologian and scientist G. Tanzella-Nitti emphasises that there are three ways to understand the notion of creation. The most interesting one for us is the third, for the understanding of which the relationship between theology, philosophy and natural sciences is of high importance.²⁰ He understands creation as the relation of permanent and basic dependence of the created on the Creator. This view of creation best explains the learning of Thomas Aquinas regarding the act of existence. The analogue relationship exists between the provider of information-order and its recipient.

Chaos theology

We assume that chaos theology provides some additional argument suitable for our reflexion. S. L. Bonting wrote:

“The initiation of this remarkable cosmic evolution, starting with the Big Bang, must have required a large amount of energy, serving partly as kinetic energy for the expanding cosmos, and partly for the formation of the primeval matter, quarks and gluons, from which arose the

light elements, hydrogen, helium and lithium. In addition, information was needed to initiate the inflation and guide the subsequent cosmic evolution. Cosmologists, who are developing a so-called quantum-gravity theory, have concluded that the information content of the early cosmos needed maximally comprised 10^{10} bytes or 10 gigabytes (data). (...) It would also appear that no further energy and information input has been needed at least until the formation of the Earth. (...) This insight has important consequences for creation theology. For the traditional doctrine of creation from nothing (*creatio ex nihilo*) it makes the problems only greater, but chaos theology can deal better with these new findings.”²¹

We understood this description in following sense: the cosmological sequence would be: energy input, information input and formation of matter.

This order of inputs we understand in case of information input as transport of information into the system. But our main point of analysis – the question “Energy or Information?” – is that information input must be prepared and that there must exist two orders: prepare the information and transport this information into the system. The information cannot come from nowhere – it must be according the first principle of any creation and so proceed to any form of energy or matter.

Conclusion

We brought up the question – what was the first: information or energy? We used the general theory of systems, the concept of development of general technology (natural technology and artificial technology) from initial to final points as well the philosophical knowledge.

So we have come to conclusion in our research that information-order had to appear first. What remains to be answered is who issued this order for the *Bing Bang* to take place.

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Energija ili informacija?

Sažetak

U opisima razvoja zbiljanja u prirodi od trenutka prapraska koriste se pojmovi ‘energija’ i ‘materija’. Sustavno, tim opisima nedostaje treća sastavnica svakog sustava – informacija. To je potaklo pitanje gdje je u tim opisima informacija i prethodi li možda ona energiji. U raščlambi je upotrijebljena opća sustavna teorija, jedna moćna metoda suvremene znanosti. Za opis opće tehnike (prirodna tehnika i umjetna tehnika), od prapraska do konačne točke (stanje potpunog mirovanja), upotrijebljen je vlastiti koncept koji se temelji na dvije misli: tehnika nije ništa posebno već sasvim općenito (O. Spengler) i fraktalno podrijetlo Prirode (M. Deege). Ustanovljeno je da u opisima nedostaju odgovori na pitanje o podrijetlu informacijskog sustava čije djelovanje započinje prapraskom. Taj informacijski ulaz dijeli se u naredbu i podatke. Uz pomoć filozofskih spoznaja, među ostalim Platona, Aristotela i Tome Akvinskog, zaključilo se da je netko morao izraditi prirodne zakone koji su u obliku informacije prenesene u energiju tijekom prapraska a prije inflacije i stvaranja materije. Posebno je važno pitanje tko je naredio

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Spaemann, R., Löw, R.: *Die Frage wozu?*, Piper Verlag GmbH, München/Zürich 1985.

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Paar, V., from private communication, Zagreb, 1997.

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Tanzella-Nitti, G.: “Creazione”, in: Tanzella-Nitti, G. & Strumia, A. (eds.), *Dizionario*

interdisciplinare di scienza e fede, Urbaniana University Press – Città Nuova, Roma 2002.

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Bonting, S.L.: “Spirit and Creation”, *Zygon Journal of Religion & Science* 41(3/2006), pp. 713–726

izradbu prirodnih zakona i početak praprasaka. Ovim se tekstom ne navodi eksplicitno tko su naredbodavac za izradbu i izrađivač prenesenih informacija.

Ključne riječi

praprasak, energija, informacija, materija, opća sustavna teorija, koncept fraktalne prošlosti i budućnosti opće tehnike, prirodna tehnika, umjetna tehnika

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Energie oder Information?

Zusammenfassung

In den Schilderungen der natürlichen Geschehnisgänge werden seit dem Urknallmoment Begriffe der Energien und Materien genutzt. Systembedingt bedürfen solche Schilderungen der dritten Komponente eines jeglichen Systems – der Information. Infolgedessen wurde die Frage aufgeworfen, wo in den erwähnten Schilderungen die Information liegt, und ob sie möglicherweise der Energie vorausgeht. In der Zergliederung bediente man sich der Allgemeinen Systemtheorie, einer mächtigen Methode der zeitgenössischen Wissenschaft: Zur Schilderung der allgemeinen Technik (natürliche Technik und künstliche Technik), vom Urknall bis zum Endpunkt (Zustand des absoluten Ruhens), wurde ein eigenes, auf zwei Gedanken gründendes Konzept eingesetzt, die Technik sei erstens nichts Spezielles, sondern dahingegen vollkommen Allgemeines (O. Spengler), sowie auf dem Gedanken des fraktalen Ursprungs der Natur (M. Deege). In den Schilderungen wurde das Fehlen der Antworten auf die Frage nach dem Ursprung des Informationssystems detektiert, dessen Tätigkeit mit dem Urknall einsetzt. Dieser Informationseingang gabelt sich in Befehl und Daten. Mithilfe der philosophischen Erkenntnisse u. a. Platons, Aristoteles' sowie Thomas von Aquins zog man die Schlussfolgerung, irgendjemand müsse die natürlichen Gesetze entworfen haben, die in der Form der Information in die Energie übertragen würden - während des Urknalls und vor der Inflation und Materiebildung. Von beachtlicher Bedeutung ist die Frage, wer den Entwurf der natürlichen Gesetze sowie den Urknallbeginn angeordnet hat. In diesem Text wird weder der Befehlshaber der Ausarbeitung noch der Entwerfer der übertragenen Informationen explizit angeführt.

Schlüsselwörter

Urknall, Energie, Information, Materie, Allgemeine Systemtheorie, Konzept der fraktalen Vergangenheit und der Zukunft der allgemeinen Technik, natürliche Technik, künstliche Technik

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Énergie ou information ?

Résumé

Les descriptions du déroulement des événements dans la nature à partir du big bang utilisent les concepts d'énergie et de matière. Une troisième composante manque systématiquement : l'information. Ce qui pose la question de savoir où se trouve alors l'information dans ces descriptions et précède-t-elle peut-être à l'énergie. Cette analyse s'appuie sur la théorie générale des systèmes, une puissante méthode scientifique contemporaine. Pour décrire la technique générale (naturelle et artificielle), depuis le big bang jusqu'au point final – l'état de repos absolu –, elle utilise son propre concept, fondé sur deux considérations : celle que la technique n'a rien de particulier (O. Spengler), et celle de l'origine fractale de la nature (M. Deege). Dans ces descriptions, les réponses à la question de l'origine du système informationnel, dont l'action débute avec le big bang, font défaut. L'entrée de l'information se sous-divise en commande et en données. À l'aide des connaissances philosophiques comme celles de Platon, d'Aristote ou de Thomas d'Aquin, il a été déduit que quelqu'un a dû élaborer les lois naturelles transmises à l'énergie au cours du big bang, avant l'inflation et la création de la matière. La question de savoir qui a ordonné l'élaboration des lois naturelles et le commencement du big bang est particulièrement importante. Ce texte n'indique pas explicitement qui est le commanditaire de cette élaboration et qui l'élaborateur des informations transmises.

Mots-clés

Big Bang, énergie, information, matière, théorie générale des systèmes, concept du passé fractal et de l'avenir de la technique générale, technique naturelle, technique artificielle