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from the volume:

***ORTOFIZICA (ORTHOPHYSICS), 1985.***

*(Working translation)*

**Parts of the chapter:**

***Cronos and cosmic rhythm without duration. Duration and time. Arrow of time. Time in physics. Time is deeper than space.***

## **Chapter 5**

### **FLUCTUATION AND RHYTHM**

#### **CRONOS OR COSMIC RHYTHM WITHOUT DURATION**

The generation of orthosenses 'from itself' is a fluctuation process. Orthosenses are produced by informatter from itself in a way that gives different results from one process of fluctuation to another. This variance is not submitted to any regularity, permanently the existence trying to constitute universes. The generation of a universe complies with the general lawful tendency 'to exist from itself' and depends of the general types of orthosenses that can be generated. The above mentioned lack of regularity refers to the fact that does not exist any correlation between the trials of universes produced by orthoexistence. The 'from itself' universes are born only by fluctuation.

It might be that other universes do not appear by mere fluctuation, but from a social consciousness (by conscious action in the deep matter), by creation. Such a creation, similar to the artistic or technical creation, might be done from a universe, by the beings of that universe, in the framework of the same lawful principles of the orthoexistence. Nevertheless, also in such a case, the fluctuation factor could not be on the whole eliminated. The created universe will begin like any 'from-itself' universe, it will have a bing-bang, will know evolution and eventually will reach life and conscious beings, otherwise it will

be only an attempt of universe, a missed universe by the disconnection of informatter from the deep energomatter (lumatia).

The two above processes are shown in the scheme of Fig.1.

This scheme is based on the general scheme of the model of the Ring of Existence. The orthosense 'into (intro) itself' represents a hunger of orthosenses that are generated by the senses in an universe or generated under the influence of the dynamics of the universe.

For fluctuation, respectively change by fluctuation, informatter must have its own 'clock', a rhythm. It is the rudiment of time, the number time without duration. Informatter has to have a *cronos* as fundamnetal as the orthosense 'to exist', and without the cronos, the orthosense 'from itself' would not have any sense.

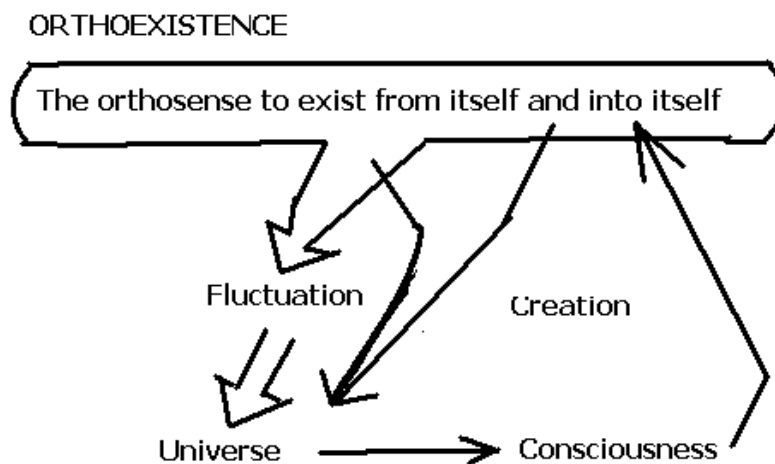


Fig.1 Two ways for the generation of an universe

It is significant, from this point of view, the intuition of some myths from antiquity that places the cronos before the gods.

The greek mythology took, it seems, Kronos (Chronos) from oriental myths (for instance the Persian *Zrvan Akarana*, the infinite time [1]). Kronos is an important figure in the cosmogonic poems of Hesiod, Orfpheus (the orphic myths, in general) and of Pherekydes from Syros. These poems presented for the first time (at the ancient Greeks) the problem of the beginning and birth of

the world [2]. This was an important theoretical position in face of nature of the Greeks from antiquity.

It is said that even until today Cronos is not a too clear figure, well described concerning his features [3], still he is a primordial god with the authority of great age in the gallery of gods, the first [4]. That is why Mnaseas from Patrai (second century before Christ) considered the equivalency of Cronos with the greatest god of the geto-dacians, named Zamolxis [5].

Among the significances of Chronos (Kronos) we are interested in those which associates him with time [6]. At Hesiod, Kronos has not yet a primordial position, being the son of Uranus and father of Zeus; the fundamental principles are *Chaos* (an infinite space), *Goia* (earth or a material element) and *Eros* (a cosmic force) [7]. For *Orpheus* (the early cosmogonies), the fundamental principles are *Chronos*, *Eter* and *Chaos*, these being before the gods. Now Chronos has the significance of time [8], being imagined with the form of a dragon with heads of bull, lion and god, being <<that without oldness >>, born from water (the principle of all things), and giving birth to the co-principles Ether and Chaos, and then to Zeus.

At *Pherekydes from Syros*, existed eternally three principles: *Zas* (fire), *Chronos* and *Chthonia* (earth) [9], but <<Chronos made from its own semen the fire, the movement of air and the water...>>[10]. *Pherekydes*, following the orphic legends, indicates *Time* as origin of all what exists, corroborated with the active Zeus (*Zas*) and the passive Earth, from which are born the Fire, Air, and Water [11]. For *Pherekydes* time is at the origin of all what exists, although it is in something, namely in water as principle of all the things.

Time before the gods, time as a god, the time as creation of the God which does not apply to the God, this is a line of evolution beginning with a naïve but healthy ideas on the origin of the universe and of the world. Such a line of thought may be recovered in a materialistic view conceiving a rudiment of time intrinsic to the deep matter.

In everyday life, time seemed to be a destroyer, but cyclic because of the rebirth of nature and, may be, the universe. Maya civilization believed that time repeats itself at intervals of 260 years. In the old Indian philosophy time repeats itself at intervals of 12000 years, because <<time as a circle, endlessly returning and never destroyed, guarantees rebirth and future life *on earth*>> [12].

With all progresses of science, the notion of time remains still disturbing and unexplained. The following quotation is showing how the cyclic concept of

time was replaced with linear time and with this appeared the idea of eternity: <<In most religions and cultures time was thought of as repetitive or cyclic, On the other hand the Greek philosophers of the period 500-300BC were familiar with the idea that the surface of the Earth was not static but was changing continuously. They thought of time as linear, and they speculated about the evolution of landscapes and the evolution of life. Later, [...], the rise of Judaism and Christianity emphasized this new view of time as linear and irreversible. As in other religions, there were the concepts of Creation (the beginning of the world and the beginning of time) and Destruction (the end of the world and the end of time), but the Greek concept of eternity was given great emphasis. Eternity was a sort of supertime, understood and created by God alone. In eternity, existence had meaning but time had not. The idea of eternity has exercised theologians and philosophers for many centuries, and much of the Bible is concerned with attempts to explain its meaning. Perhaps "eternity" is simply a word used to describe time on a scale that is beyond human comprehension: time before the advent of Man and also time beyond the end of Man and the end of planet Earth. Perhaps the concept of eternity evolved as the result of a corporate insight that there is an absolute timescale for the history of the Universe - a timescale of far greater significance than any relative timescale based upon human experience >> [13].

The notion of time has now to be followed along the ring of the material world, to be understood in this context. Perhaps without an orthophysical view time cannot be understood, and its absolute root begins with its tact (beat), informaterial rhythm, that we shall name *Cronos*.

*Cronos* is not yet time, it is only the tact of the entire cosmos, the rhythm of the cosmos, the rudiment of time from the depths of the cosmos; it is neither orthosense, nor information. If an orthosense is phenomenological information, *cronos* is another type of physical phenomenological process, it is the rhythm without duration of changes in orthoexistence. *Cronos* is still the intrinsic 'clock' of the cosmos. The dynamics of the entire nature is based on *cronos*, the cosmic rhythm: *Cronos* is the philosophical name, *the cosmic rhythm* - the poetic name.

Fluctuations are not possible without *cronos*, and they are producing orthosenses. All the processes of fluctuation and rhythm from nature they have here their origin, in the primordial data of matter. The fluctuation and the rhythm assure the new, the non-automaton behavior of the cosmos before any consciousness.

Informatter fluctuates and presumably our universe was born rather by such a fluctuation than by an organized approach. Our universe was born by the fluctuation of an informaterial point at a tact of the fundamental rhythm (cronos). Perhaps, one produces, in the beginning, a first constitution of informaterial cells with topological orthosenses and of interaction, y compris for coupling and division. At the following tact appear phenomena of division, of the growth of the universe and the beginning of the interaction of its cells, under the lumatia (energomatter) stratum. Any change and movement is not possible, but in the tact of cronos.

Although at every tact of the informatter new universes are born or only new trials of universes, an universe once born by the coupling of informatter with lumatia, takes on its account the tact of the cosmos, and develops itself in the tacts of the cronos on the basis of initial orthosenses, and if it will look for new orthosenses, these will not be received from the informatter "from itself", but only "into itself" through living beings and social consciousness.

The fluctuation that creates a universe generates a family of orthosenses or a poem of ortosenses or a simphony of orthosenses. The point of departure of an universe by fluctuation does not result from a reason, from a calculation, only "from itself", in a poetic or symphonic way, but respecting some fundamental rules, tendencies. And for what is born one finds always a reason, logic and mathematics, to explain partially what was born.

## DURATION AND TIME

There is no cosmic time, only a cosmic cronos. Cronos is a property of informatter. It is not time, only a tact, an informaterial 'clock' in those 'zones' of informatter out of which an universe develops. This clock, without duration is external to the universe, however becomes with duration and therefore becomes time (number and duration) through quanta of time in the universe. Only from the moment of the apparition of a universe the numbering of the cosmic cronos by quanta of time begins to have a sense. And the sense of time may manifest only in living organisms, especially in the human and social minds and consciousness.

How bestows a living organism duration to the events surrounding it? Any living organism has the sense of time? It seems that most of the organisms are living only in the present now, although it is known that some species know

temporal adaptations, namely some biological rhythms connected with some cyclic events in the neighboring nature.

The action of a living organism in the universe does not follow the rhythm of the cosmic *cronos*, but it acts at another scale, in other rhythms. The living organism cannot digest the changes in the usual space in the 'time number' of the cosmic *cronos*, however it integrates and continuifies in *duration* [14] the quanta of time. For living objects the *duration* has *sense* and this is due to the informatter to which they have access (intro-openess). In informatter is generated the sense (orthosense) of duration. The duration is an orthosense 'intro'; without duration the living organism could know only the orthosense "to be" that is transformed in the sense of "to being" [15].

*Informatter in itself and from itself does not know the duration. The duration is generated in informatter, only in "intro" manner, as an orthosense. Being sense and orthosense, the duration is a phenomenon of the living matter, the non-living world does not know it, neither the orthoexistence.*

Without duration can not exist consciousness, and the depths of the material world, in themselves, does not have consciousness {n1}.

The integration of the durations in relation with spatial change leads to the sense of *time* developed only by superior animals and especially by the man. This integration and continuification is possible due to the intro-openess into informatter, to the *time* corresponding a sense and orthosense superior to the duration, time being not directly natural, but filtered by consciousness and intelligence.

*Cronos* is tact, rhythm, being absolute and objective. What can be said about duration? Is it subjective or objective? From one point of view duration seems to be, after many authors, subjective, as sense, however through the quality of orthosense of the duration, without which can not exist the sense, it is objective. Any orthosense is an objective physical phenomenol-ogical process. The duration as orthosense is not subject to mathemematics, only its consequence in time, when it combines with rhythm (number). No orthosense in itself can be mathematical, only its relations with other orthosenses may be; mathematics applies to the relations in a set and among sets.

The duration has an objective basis, by its orthosense, generated by any living body in intro-open contact with informatter. Not only what can be submitted to mathematics is objective, also what is phenomenological as a physical

manifestation of informatter is objective. Only the individual shaded senses are subjective, and these manifest themselves on the objective background of orthosenses. A mixture of senses may give an individual specificity to a basic sense because it is accompanied by secondary associated, permanent, or sometimes temporary senses. Any isolated sense, purified, almost is reduced to an orthosense. In living bodies and especially in the superior ones we don't meet isolated senses, only packets of senses that may paint differently, from one individual to another, and even to only one individual, in distinct moments of his life, a basic sense. The background of all the senses is objective, because they are still orthosenses, but their combinations may give subjective tones. Sometimes may be developed packets of senses without a dominant sense, a bit confuse; they might and should determine neuronc structures in the brain, which at their turn awake new senses and orthosenses. This might be also a mode of creation of the human mind.

*To the sense of time corresponds an orthosense of time. The objectivity of time stays in the tact, its fundamengtal rhythm to which is added the sense of duration with an objective orthosensorial background.*

Duration is sense, and in fact is orthosense. The continuification of time constituted by quanta of time is another sense (orthosense). This continuification is objective as ortheosense, but subjective as individual time.

The unity of time is the quantum of time, as the unity of space is the quantum of space. In practice and in physics we work with other unities of time than with quanta of time, with unities that are accessible at our microscopic level. But we should not forget that a time shorter than a quanta of time does not exist, the quanta of time embracing and hiding the rhythm and duration.

Not only the durations are integrated and continuificated in the sense (orthosense) of the time. Even the time, from a certain point of view, may be integrated in a unity: a musical melody developed in time, looked as an idea, is caught in a sense, in a way non-temporal, not sequenced in time; in a like manner, a spoken phrase in time gives an idea or a sense which in itself has not duration. The time may be concentrated (this has nothing to do with the relativistic mechanics and its contraction or dilatation of time), it might be altogether contracted if we renounce to the orthosense of time and reach the unitary level of informatter, eliminating the durations. Evidently, we have such a possibility to concentrate a melody, an idea, the sense of a proposition into an orthosense. The reverse process is also possible, the expansion of a sense in elements with duration, that means a development in time.

## THE PHYSICAL, BIOLOGICAL AND MENTAL RHYTHMS

Cronos, the cosmic rhythm, is present in the intro-openess of any living body. It is not easy to say which is its effect on the organism. On the one side, every organism knows bio- rhythms that take place at quite another scale than that of the quanta of time. On the other side, these bio-rhythms could be a consequence of the fundamental rhythm even if mediated by a chain of processes. And we don't know yet if in the depth of the mental-psychological life some synchronization and consonance of rhythms are not produced in connection with the fundamental rhythm.

From the works of Prigogine in the domain of thermodynamics it is known that there are chemical processes which have a stable oscillatory character, mathematically described by limit cycles; for a limit cycle is typical the fact that independently of initial conditions (in a defined domain of initial conditions, sufficiently large) one obtains always the same limit cycle (Fig. 2.). Any perturbation of a stable limit cycle brings back the system to the same limit cycle.

The chemical process described by a stable limit cycle is characterized by the fact that no perturbation is capable to let the system escape from what constitutes a real chemical clock [16]. Nature creates structures with clocks, with an intrinsic rhythm, not imposed from outside, and this happens even in non-organic world. Such processes are described by nonlinear dynamic equations very similar with those of the theory of nonlinear oscillations in the domain of electronics. Prigogine and Stengers observed that while the nonlinear reactions

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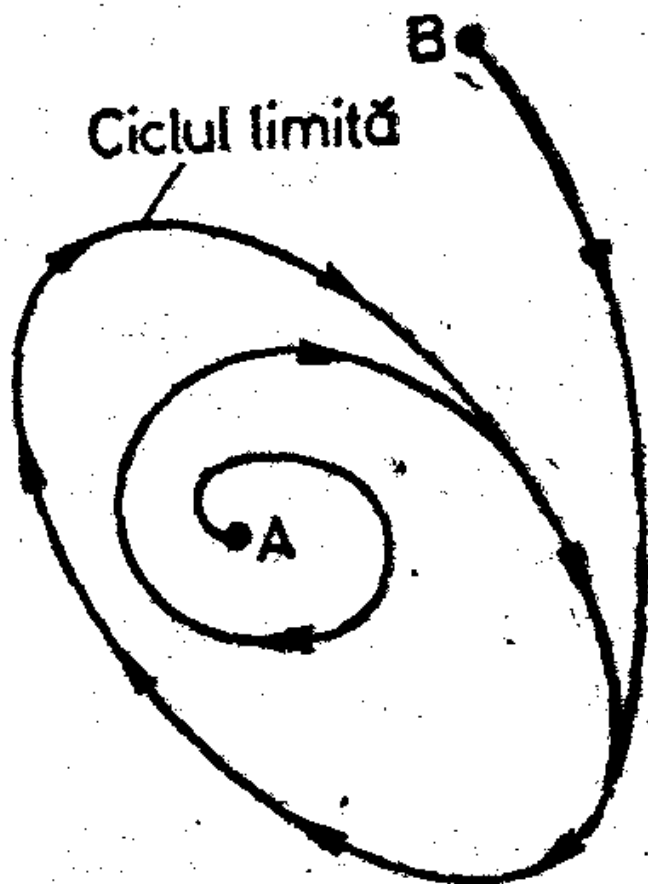


Fig. 2. Independently of the initial conditions (A or B) one obtains always a limit cycle, the arrows showing the evolution in time.

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are scarce in the nonorganic world, the molecular biology discovered that they are the rule in living systems [17]. Such processes are very far from the ideal situations that can be described in terms of fundamental concepts of classical or quantum physics [18]. They may be explained, in the greatest part, by the nonlinear irreversible thermodynamics elaborated by Prigogine, where a central notion is the *dissipative structure*. The known chemical and biological oscillations are macroscopic processes which manifest in dissipative structures formed by ensembles of particles with superior organization, which can not be described by the classical principle of order of Boltzmann [19]. The chemical and biochemical self-organization begins with an ensemble of molecules in conditions far away from the thermodynamic equilibrium, which are nonlinear. This happens when the ensemble of particles reaches a critical point, a

bifurcation. When the system reaches such a point he becomes unstable, having two-three possible solutions to follow: one, eventually, of the same type as the previous, and one or two new solutions. The solution that is choosed depends on the effect of a fluctuation, a small fluctuation, that destabilize the system, a fluctuation that is amplified leading to a new structuration of the ensemble of molecules. This is named an *order by fluctuation*. The dissipative structures appear by such bifurcations, in general for greater ensembles of molecules, because a too small system is completed dominated by the environment [20]. Only by growing the system, this may discover new regimes of functioning [20]. In the evolution of the system, under constraints of the environment, may appear successive bifurcations or dissipative systems to be parts of greater dissipative systems, more complex, such as in living superior organisms.

As a dissipative structure has its own clock, it is possible that complex structures to have more clocks. Indeed, the man, for instance, has more types of internal rhythms. At the cellular level there are oscillations of the metabolic concentrations, the glycolysis (production of energy from carbohydrates) playing an important role in the periodical behavior. The man knows the rhythms of heart, respiration, temperature, endocrine rhythms, some depending on external cycles (day-night, for instance), other being strictly internal.

In the last years the bio-rhythms are studied more intensive [21]. Without any doubt it was shown that the migrating birds have an internal clock which *is not an adaptation to the external cycles of the environment*: "This is not to say that the body clock is unaffected by the environment [...] the internal clock must function to *aid* the organism's adjustment to the surroundings and its cyclic changes, not the opposite! Just like our own mechanical clocks, the accuracy of body clocks is maintained only by repeated reference to more accurate time sources" [22]. The internal clock needs to be confronted with an external clock (day-night, for instance), not at a specified moment, but in time. If an organism is maintained a sufficiently long time in darkness "in the absence of environmental time clues, some clock ran fast, and some slow" [23].

Recognizing the internal clocks does not mean the explanation of their nature, but the non-linear self-oscillating dissipative structures are a very good general model. On such a basis may be explained the internal clocks, and also their synchronization with external rhythms, the phenomena of synchronization being wellknown in the theory and practice of non-linear oscillations.

The unicellular alga *Acetabularia* has a clock imposed by the nucleus of the cell, but if the nucleus is removed, the cytoplasm remembers the rythm and

maintain it for the photosynthesis process. If a new nucleus is introduced, it follows the rhythms of the new nucleus [24].

In multicellular organisms there are both cellular clocks and clocks that assure the coordination of the functioning of various tissues, perhaps by endocrine and nervous messages.

The greatest interest presents, undoubtedly, the 'ultimate' internal clock of the living object, as could be the clock at the level of a cell or at the level of the nucleus of the cell. A suggested model for such a clock was elaborated by Charles Ehret [25]. In a cell, the nucleus contains chromosomes built from nucleic acids that carry the genetic information and various proteins, while the cytoplasm contains ribosomes, which are devices for the fabrication of proteins. Ehret considers that sequences of DNA are organized in 'chronons': the process of *copying* into RNA begins with the first gene in the sequence, then stops until the corresponding protein of the first gene is synthesized and an inverse diffusion of the produced protein starts the copy of the following gene and shuts off a new copy of the previous protein. When all the genes are read and the last protein is synthesized, this last one restarts the entire process. The chronon is a specific clock constituted of cycles and steps in every cycle. Ehret admits that there must be various chronons in the DNA of a cell, not all of them functioning simultaneously, depending on diverse biochemical processes in the cell.

Chronons or chemical oscillations, not without links among them, offer internal clocks at cellular level on which are superimposed various biological rhythms of the subsystems of an organism. For that reason it is said: "Time not as a clock, but as an organism; not as a single rhythm, but as a whole symphony, so entwined with the processes of the living body as to be indistinguishable from the life itself [26].

The organisms need of an internal clock or of clocks for their various subsystems. Consequently, the clock, rhythm, is inherent to life, reflecting, at another scale, the cosmic rhythm. *But time is much more than this rhythm, or any rhythm. He presupposes the sense of duration, of the past and of the future.* If the *duration* has to be impelled in any living body, that through its intro- openness, at this level, confronts the informaterial rhythm with the biological internal one and with the external physical rhythm, the *time* is bound to the human mind because only he is conscious of time, the time being not a property, in itself, of the mind. The process of confrontation of the biological and external rhythms with the fundamental informaterial rhythm is not a conscious process, there is no sense organ for this process. But such a process

could influence unconscious structures of the brain, and by this way the human mind may be not too far of the cosmic rhythm. And if it is not strange to the cosmic rhythm, it is not alien to the fluctuations of informatter.

## ARROW OF TIME

Cronos is not yet time, it is only tact without duration, every tact being accompanied by a fluctuation of informatter or a movement in informatter when it is coupled with energomatter. It may be said that cronos has an arrow which might offer an absolute foundation to the time? This can not be said at the level of orthoexistence in its whole, also for informatter in its entirety and unity, and we have to look carefully at the zone in which an univeses is born.

*Any universe is born with an arrow of time*, and is almost unconceivable how in relation with the total evolution of an universe are maintained sometimes doubts on the objective nature of the arrow of time. It is true that from the very moment of the building of the newtonian physics, the laws which governed the movement of bodies and of the universe were and are, in this framework, reversible in time. The Maxwell's laws of electromagnetism, too. The laws of quantum mechanics, for instance Schrödinger's equation, too. For all these laws there is not a physical arrow of time. Moreover, if the entire social practice shows that in the macroscopic domain of complexity and of the living the time goes only in one sense, we might ask if this is due only to a much higher probabily in comparison with an inverse flowing course of the time; on the contrary, in the microscopic world of elementary particles it is considered that the time may really go back.

For Newton, the time was absolute, from itself, like the space, both forming the cadre in whice the movement of bodies developes. This time reflects nevertheless something from the absolute rhythm of the cronos, and its conception was, therefore, *a half truth*, in the light of orthophysics. The vision of Newton led to the invention of mechanical horologes and clocks, that reflect, in a way, the fundamental cronos. The human world adapted itself not only to the rhythms of the environmental nature, but also to these mechanical clocks, that become later electronic or atomic clocks.

For Einstein, who did not renounce to clocks, the time becomes relative with regard to the speeds and accelerations of various reference systems. Locally, always, the time has the same tact, either in the special theory of relativity, or in the general theory of relativity. This is absolute and it is surprising to hear that

due to the theory of relativity the time has nothing absolute, that there is not absolute time. Only a second inertial observer, not being in the field of gravitation of a clock with the first observer 'sees' the respective clock going slower. This is due to the constancy of the speed of light in vacuum, in universe, relative with any system in movement. For this reason, two observers in movement will not agree that two events are simultaneous. That is why for every of them the time is flowing differently, for *one of them relative to the other*, although, *locally, for each of them*, time is flowing in the same manner! As we have seen (concerning the maximum speed of light in the universe), the theory of relativity needs a point of a physical key for explaining its fundamnetal postulates. The theory of relativity is logically developed beginning with its postulates, but even these must have a physical base, that perhaps only an orthophysics view might offer.

*The relativity of space and relativity of time are effects of the relative movements in the universe. But space and time have absolute roots in orthoexistence.* Relativity itself is relative because it has absolute phenomena at its physical bases.

Physics has to go back towards the absolute characteristics of space and time. If this seems evident in the light of orthophysics, and if we think of the quanta of space and of the quanta of time, and to their sources, still remains open the question of the arrow of time. For orthophysics, when an universe begins from an informaterial 'point' and grows by 'division', such a movement in cronos, which refers to the universe in its *entirety*, and at the creation of quanta of space and of substance, this a process that confers to the cronos a direction by increasing the multiciplity, before any movement in the interior of a given universe. To establish the laws of physics without taking into account the processes of the beginning of the universe is not legitimate from philosophical point of view and any physical interpretation and philosophical interpretation without this initial of all the initials can not lead to sound conclusions.

The dynamics of Newton needs initial conditions. If the universe with all its bodies is given (known) at a certain time  $t_0$ , for  $t > t_0$  it develops due to the universal gravitation laws. But, as well, we can follow the evolution for  $t \rightarrow -\infty$ , for the same ensemble of bodies. As this is not the *initial reality*, the laws of Newton have a limited range of application, although large enough and important. It is necessary to add to these laws the *arrow of time*, as a *complementary law*, and Newton had this intuition.

In Fig. 3. are shown the domains of science that imply or not the arrow of time. The birth of a universe and processes at macroscopic, biological and social

levels imply the arrow of time. Is it possible that on the basis of simple isolated processes, where the mathematical formulations contain a reversible time, to consider that time is, in general, reversible? This an

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Cronos	Birth of the arrow of time	Processes without arrow of time		Macroscopic processes, biological, social, with the arrow of time
Orthoexistence	Birth of the universe	Dynamics of elementary particles	Newton's laws. Maxwell's laws. Laws of the theory of relativity. Laws of quantum mechanics.	Thermodynamics. Biology. Society.

Fig. 3. Processes with and without the arrow of time described by the contemporary science.

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error of extrapolation, as if a simple process of interaction among a few particles or bodies could take place in a inverse way in time, without a connection with all the processes in the universe.

The birth of a universe brings the arrow of time. In essence, the arrow of time is bound to the totality of the universe, therefore to the *ensemble* of all quanta of space and of substance that compose the universe. The arrow of time is always present and has to manifest at all the levels of the universe, beginning with those submicroscopic and microscopic up to the macroscopic level {n2}.

The arrow of time is not cosmic, it is of an universe, but on the background of cosmic cronos. The arrow of time begins from the very moment of the birth of

the universe. There is an 'interval' when the universe is established, as 'long' as there is a division of the cells of substance. The beginning of the universe is antientropic. The arrow of time is not linked only with the increase of entropy as in classical thermodynamics, but depends of a process of the ensemble of the universe, y compris the initial antientropic period.

Considering that the basic laws of the universe refers today to the elementary particles and because these particles seem to be indifferent to the direction of the arrow of time, it was formulated the principle of the symmetry of the reversible time (the T principle): any sequence of events, if executed in reverse order, is possible [27]. In 1963 it was possible to say that this principle is valid also in the macroscopic world because this is constituted from microscopic particles. For this reason, it was considered that the invariance of the reversibility of time is absolute, being as universal as the absolute laws of conservation. To solve the microscopic-macroscopic paradox of this situation meant to recognize that possibility does not mean probability [28]. For the authors of such considerations, what is extremely hardly probable is not impossible. In such a vision, the laws of physics would not be violated, if from the fragments of an explosive shell, the shell would be reconstituted. And then one might ask when the improbable becomes so extremely improbable to be named impossible? [29]. The paradox of the symmetry of the laws of nature with respect with direct and inverse time is considered to be solved by probabilistic ideas.

For such a mode of seeing the above situation, we presented a principium that does not admit to separate the processes from an universe from the birth of the universe and, therefore, from the ensemble of the entire universe. Indeed, it seems that physics, after renouncing to the universality of the principle of parity (principle P of the image of space in a mirror which leads to a real physical process) because it is not confirmed in all the cases, has, following the last experimental results to renounce also to the principle T.

The principle of the arrow of time, justified by orthophysics, must to be manifested, in a way, beginning with elementary processes met in nature.

Besides the principles P and T, in physics, it is known also the principle C of the conjugated charge (it refers to the replacement of a particle by an antiparticle). After it was seen that the principle P is no more absolute, it was considered that the application of both symmetries C and P leads to an absolute CP principle. If T is considered absolute, the principle TCP resulted absolute. But it was observed by experiments that the disintegration of the mesons K is done with the violation of the principle CP, named also the principle of

combined parity [30]. In such a case: "if CPT is to be preserved, this can be achieved in this reaction only if T is also violated. The violation of CP 'cancels out' the violation of T so the operation CPT is preserved. It looks, then, as if the decay of these particles shows that there is at least one process at the subatomic level which does violate time-reversal symmetry. That example apart, there is nothing in microscopic physics to suggest that time must flow one way or the other" [31].

The theorem TCP is considered very indisputable as a measure of invariance of the ensemble of such processes, and as a consequence is preferred the violation of the symmetry of time.

Either with this process, sometimes overlooked, being considered a minor one, or with other processes that will be discovered in the future, the violation of the symmetry of time is inevitable due to the more general law of the arrow of time of the universe [32].

If the laws of nature at the microscopic level (that appears as basic laws) seem to be respected also for the inverse flowing time, this seems possible, in the light of the above considerations, when

- there are not some weak interactions, like those of the disintegration of the mesons K or even a ultraweak interaction considered until now as nonessential [33];
- does not take place effects of ensembles, of agglomeration of particles.

Nobody doubts about the validity back in time of Newton's laws: if the positions and speeds of the bodies, at a given time, are known, we know not only their situation in the future, but also in the past. However the last procedure can not be extended back for a non-limited time. The problem is the origin of the universe. The same happens with the elementary particles. Their laws can not be applied back for any time. Towards the origin of the universe, at least, will take place asymmetric interactions in time.

Looking over the arrow of time demonstrated in thermodynamics and biology, it was believed, on the basis of the laws of elementary particles, that the reversibility of time is a fundamental law, but this was a hasty generalization, on the basis of physico-mathematical equations that refers to local processes, relatively isolated and limited in time.

The existence of the arrow of time, justified from an orthophysical point of view, leads to the treatment of the universe as an ensemble of particles and

then, in general, the ensembles of particles must have priority in comparison with their isolated study. From this point of view, the efforts of Prigogine to proceed from the macroscopic thermodynamics and its 'macroscopic' time to the physics of microscopic ensembles and their 'microscopic' time present a great interest.

## TIME IN PHYSICS

The arrow of time appeared in the physical sciences with thermodynamics and the entire adventure of thermodynamics is as fascinating as that of the quantum and relativistic electrodynamics [34].

The notion of entropy was introduced by Clausius in 1865, expressing the irreversible evolution of a macroscopic system, introducing in physics the notion of the arrow of time: 'for any isolated the system, the future is the direction in which the entropy is increasing' [35]. The macroscopic processes are built from microscopic processes, from an ensemble of microscopic processes. If the microscopic processes do not know the arrow of time, how may it manifest at the macroscopic level? Boltzmann established a kinetic equation (used also today, for instance, in the solid state physics [36]) that takes into account the *newtonian dynamics of particles*, and also the *collisions* among particles. The function  $f$  of distribution of particles, of a system of particles, varies in time due to the two factors mentioned above:

- a.  $(\partial f/\partial t)_{\text{dynamics of trajectories}}$ , which is the reversible part because it has the usual symmetry of the equations of newtonian dynamics ( $v \rightarrow -v$  is equivalent with  $t \rightarrow -t$ );
- b.  $(\partial f/\partial t)_{\text{collisions}}$ , which is the irreversible part, because even if we put  $v \rightarrow -v$  the system still will tend towards equilibrium, the collisions will continue, being invariant with respect to the inversion of speeds.

The second term explains, after Boltzmann (1872), the microscopic origin of irreversible behavior. The collisions of the microscopic particles bring the irreversible nature of the process independently of the nature of the collisions. Prigogine and Stengers consider this interpretation as 'the breakthrough of Boltzmann' [37] because it offers a deep intuition of the irreversible processes. At the same time they consider this breakthrough to be only half a success. It is a success because the entropy can now be reduced only to dynamics, to the world of trajectories, but to processes that classical dynamics could catch, to a breaking of the symmetries of equations with respect with time. It is also an

unsuccess because the sources of the entropy and the arrow of time should have, after Prigogine, quantum roots, not classical. We can not but agree with this taking into account deeper roots than the quantum ones, the orthophysical roots of these processes, which manifest themselves at the quantum level.

It is known that Poincaré, W. Thomson and Loschmidt [38] made objections to the irreversible character of the Boltzmann's collision term showing that the process of collisions may be reversed, but this would mean that could manifest antientropic phenomena. Even Boltzmann admitted later that antientropic processes are not only permitted by the statistical theory, they are real. But they appear at unbelievable large intervals of time and therefore are irrelevant for the description of the real nature [39]. With this interpretation, the predictions of the law of entropy are fulfilled with a great probability, but not with an absolute certitude.

It is interesting that Boltzmann considered a '*fluctuation*' being a behavior contrary to the second principle of thermodynamics and characterized the image of the 'thermal death' of the universe formulated by Clausius as a lack of taste. For Boltzmann, it is possible that a state of low entropy of the universe, existing always, to be the result of such a fluctuation. Referring to Loschmidt, Boltzmann did not accept the idea of the former that some minuscule intelligent beings that are able to see every gas molecule individually and with some device to separate the molecules with great speed from those with slow speed, and in this way when all processes will cease, to be capable to generate new temperature differences [40]. This is a form of Maxwell's demon, but Boltzmann prefers the intervention of a natural fluctuation of the type of the reversibility, but of very small probability as was described before.

In reality, the fluctuations are fundamental in all statistical physical ensembles, they are always present and does not appear with a low probability, they are permanent, even if their mathematical description is probabilistic. And they have, in the last instance, an orthophysical origin.

Because also the laws of quantum mechanics are reversible in time, Prigogine considers that the problem of irreversible processes, far from being solved by quantum mechanics, is to be put with keen urgency [41]. In quantum physics any measurement that implies a macroscopic device introduces an element of irreversibility, and Prigogine observes that quantum mechanics is leaded to postulate the coexistence of two types of irreducible evolutions, the reversible and continuous evolution described by the equation of Schrödinger, and the reversible and discontinuous reduction due to the measurement [42]. Confronted with this situation in physics, Prigogine observes that some

physicists take refuge in subjectivism (the irreversibility being introduced by our measurements or by our spirit), that others ask an extension of the equation of Schrödinger to take into account the irreversibility of the measurement, but he does not agree with both these positions. He thinks, in essence, that the microscopic world can not be treated isolated, but only as an ensemble, asking for a synthesis of the simple and the complex. For this, Prigogine proposes to introduce in quantum mechanics new operators, additional to the classical ones introduced by Heisenberg. This seems to be indeed necessary for describing systems more complex than those usually described. One of these operators refers to an internal time of a quantum ensemble and another to a microscopic entropy. To the operator 'internal time'  $T$  that is associated to the internal state of the quantum system corresponds a medium time  $\langle T \rangle$  and fluctuations of time  $\langle T^2 \rangle - \langle T \rangle^2$ ; to the entropy operator  $M$  corresponds a medium entropy  $\langle M \rangle$  that has the significance of the macroscopic entropy. Of course, there are in this model and fluctuations of the macroscopic entropy. Such an articulation of the dynamic descriptions, probabilistic and macroscopic, represents for the time being a *tentative* to search an arrow of time at a deeper level than that of the macroscopic reality in order to explain the arrow of time put in evidence by thermodynamics, geology and biology.

In the light of orthophysics, the idea of Prigogine to find the entropy and the arrow of time at the quantum level is justified. The concrete form of the solution has still to be validated by science. For us, the connection between the cosmic rhythm and the time of a structure, as it is the quantum universe, has to be, because if the time is the consequence of change, then these changes are possible only if there is a *cronos*. The effect of complexity of an ensemble of particles brings new elements regarding the time, but these has still to be anchored in *cronos*, even if different structures will generate their own times and the nature will know a multiplicity of times.

## TIME IS DEEPER THAN SPACE

*Cronos* is a rhythm, a tact, not complete time with duration and arrow. The arrow of time manifests in the universe, for every universe apart. Both *cronos* and arrow of time might explain how isolated processes are described by laws without the arrow of time, *reflecting the fundamental cronos*. But we have seen that in reality from the very moment that such processes take place in universe, to these laws must be added, as an associated law, the arrow of time.

That is why we say that a cosmic time does not exist, only a cosmic *cronos*. If the law of the arrow of time is a law of the universe from the moment of its beginnings, this law refers to all processes in the universe.

Not having an arrow of time, it is difficult to understand the *cronos*. The cosmic rhythm does not mean neither forward, nor backward. Only when it becomes the tact of the the universe, it becomes ordered with a direction and sense.

Consciousness without duration is not possible. Consciousness without time is not possible. While the informatter has *cronos*, it has not space, only topological senses, The topological orthosense is not as fundamental as the *cronos*. Time seems to have a deeper root than space, although the time with duration appears by orthosense, like the space.

If the *cronos* would assure the orthosense of duration in informatter and with this also the consciousness, then informatter would be a form of consciousness. We did not accept such a point of view considering that the duration created in a complex alive structure, is realized through its intro-openness into informatter. Only a structure with the arrow of the tact of the universe may produce the orthosense of duration in informatter. If the *chronos* would create, in itself, duration, then the *time* would be a fundamental element in informatter, it could flow both forward and backward, without any order of flow; may be, in some 'zones' of informatter it flows forward, in others backward, without an order of the flow. And when such zones couple or uncouple, the time would not flow in an ordered way and an arrow of time would not be possible.

In fact, the *duration* does not manifest before the arrow of the tact of the universe, the duration being a consequence of this. When duration manifests, then determines the full time giving a content to the arrow of time.

*Cronos* without arrow, the fundamental *cronos*, does not generate duration, therefore is not possible for informatter in itself to have consciousness. Informatter has the phenomenological sensibility of the 'in itself' orthosense and participates to the consciousness by 'into itself' orthosenses.

The living and consciousness being intro-open into informatter, the problem of time with respect to consciousness is not easier because consciousness has contingencies with internal and external arrows of time, but also with the fundamental *cronos*.

The physics of time is not split of the psychology of time because the existence of the component *duration* of the time, although it is based primarily on the

component of succession, of change, of the time. It was observed [43] that the unity of time, contrary to that of space, is not a part of the quantity that is measured, as a standard, but a cyclic phenomenon for which is postulated the equality of the periods.

We measure the time, attributing to the duration an objective character, framing it in the cycle of a clock. This is the physical way to evaluate duration and time after the *content* of the development of events. There is also a logical way to conceive time, that make abstraction of this content to constitute temporal intervals delimited by instantaneous moments [44]. In such a way proceeds also Octav Onicescu, who, based on the experience of time, observes the identity of substance of durations, independently of the events to which they refer and of their possibility to be measured [45], and proposes a mathematical model, a 'construction of moments and durations' [46].

Piaget already observed that between the physical and logical estimation of time there is a similar situation with that between the physical knowledge and logico-mathematical knowledge [47]. In the first case it is the question of a relation of the logical knowledge with physics, but remains also the question of the relation with orthophysics where other objective components may intervene by the mediation of the mental-psychological.

Without any doubt, the idea of causality appears first in consciousness in connection with the temporal flow observed in relation with the external events of consciousness. There is no intention to debate here the problem of causality, that is fundamental for the rational thinking and science, we mention only that we are on the side of those that do not eliminate probabilistic, statistical, phenomena from the sphere of causality, that can not be reduced only to a determinism understood in the way of classical dynamics. The problem for us is the link between *cronos* and causality, as objective process observed by consciousness. In a way, *cronos* is a factor of order in orthoexistence because it is the rhythmic background of any cosmic order, it is the rudiment of causality. Together with the arrow of time in universe is assured in an absolute way the causality, and the consciousness has to recognize it, but not necessarily with relation with itself, with its intro-openess. Consciousness is anchored in cosmos having access to informatter and *cronos*, it may create in causality with the universe and with its mental world, but it may create also without this causality, from itself. Thus, it goes to a causality with other nuances than the rigid deterministic or probabilistic causality.

Due to the ontological model of today, psychology, concerning the brain, relies on physics and biology, but concerning the mental phenomena the accent is put

on subjectivity. This happened also for the study of time. However, recently, in some works, time is interpreted as *information* [48], and this is very interesting from an orthophysical point of view. Regarding the time as information, to the time has to correspond some structures and phenomenological senses (orthosenses). For John A. Michon the time manifests itself as a characteristic of the flow of information that presents to us as a reality [49]. For him there is no fundamental difference between this characteristic and other distinct elements of the information configurations as are the colour, sonority or place [49]. Indeed, Michon observed the identity of nature of all mental processes from the point of view of senses (orthosenses), in our interpretation. Michon understands temporality as a temporal structure of interaction between the human organism and his environment [50].

The analysis between the internal biological behavior and external changes leads John A. Michon to interesting results:

- a) the greatest part of a temporal behavior is produced by an automated processing of information and there are innate temporal *schemes* that permits a synchronization with external events;
- b) when there are not available innate temporal schemes to face external events (sometimes because the latter have not an obvious temporal structure), then one passes to the conscious processing of the temporal information, to the creation of new model to construct reality. Now, the time is not only *perceived*, but also *estimated* [51], and subjective cadences of the time appears, because the attention is driven, more or less, on the time. The far as the temporal field predominates over the other informational fields, the more rapid is the subjective time. An important role plays in such processes the exchange of information between short term memory and the permanent memory;
- c) based on the psychological researches of the last hundred years one observes [52]:
  - the *present* has usually a mean duration of 2-3 seconds, but sometimes it may have a maximum of 30 seconds;
  - for two consecutive events to be perceived as independent events it is necessary around 150-250 milliseconds; if the duration between two consecutive events is of 250-850 milliseconds (with an optimum of 500 milliseconds), then the temporal structure is easier perceived [53];
  - the information taken in a duration felt as *present* is a discrete unity (segment); the limits of such a segment are determined by structural properties of the events, both temporal and non-temporal. If there is no

intrinsic structure in the series of events, then one proceeds to a subjective segmentation of the series (subjective cadence) [54].

The last assertion, by which the present is interpreted as a discrete unity, a segment of time, which when it is not imposed from outside with respect to the biological interior (the above time constants are, first of all, biophysical data) it is created in a subjective manner, raise the question concerning the mental-psychological continuity, in general.

Is it primordial the psychological discontinuum and from it is composed the continuum? And the psychological discontinuum is it not a fragment of the continuum and as such the continuum is fundamental? Every letter, be it A, is it not written with continuous segments? And a word, with only one sense, is it not constituted from the discontinuity of its letters?

A linear segment from the letter A is, at its turn, constituted from discontinuities if we look through a microscope the ink that forms such a segment, seeing stains or discrete points. Every stain has its own continuity. But it is formed of molecules etc. Therefore, we meet a constant imbrication of continuum and discontinuum, and as we have seen the universe itself is born with such an imbrication. The mental-psychological presents no exception. Sometimes the accent is put on the mental-psychological segments, as does Virginia Woolf in her literature, recognizing also a continuous integration. She observes how a human being feels how life, beginning to be made from small separated incidents, lived one after the other, becomes undulated and entire like a wave [55].

May be the philosophical tension has also such a component, namely this position of man to be between continuous and discontinuous. The universe begins from the unity of the cosmos, it contains a part of this unity; a living being, in the same manner has a reference in its unity and the discontinuum is inscribed in the continuum of this unity. *For the living, the continuum is more important than the discontinuum*, otherwise how could it recognize, from a segment of time to another, to be itself. In the continuum of life one manifests the discontinuum, and from a mental-psychological point of view, it can be determined by external, internal and intro-open causes.

In conclusion, the cronos in itself does not assure the arrow of time. The fundamental rhythm, tact, has not in itself an arrow. Every universe in the cosmos has its own time, linked to its processes. About cronos in cosmos one can not say that it is going forward or backward. Between these limit situations,

cronos and the arrow of the evolution of an universe, are there intermediary situations or mixed situations?

Cronos brings a certain order in the orthoexistential processes, being the rudiment of causality and especially it is the frame for changes, for movement.

Any space is born due to the topological orthosenses, and the space is born in the cosmic rhythm of the cronos. That is why the roots of time seem to be deeper than those of space. We might ask about the intuition and the thinking of *Zoroaster* who considered, 1000 years b.Chr., the time as primordial. For him nothing was before the time, time was the only uncreated thing, being from ever and for ever, producing the first substances like water, light and fire, and the gods themselves coming from these primordial substances [56].

Cronos is primordial, still it is not residing in itself, but in informatter; it is true that, at the same time, all what manifests can develop only with chronos, in the cosmic rhythm. From such a point of view the intuition of *Zoroaster* seems to be significant.

## NOTES

{n1} When this text was written (in the years 1980s in Romania), the author considered the duration as an important factor for a consciousness in a universe, and did not consider the possibility of a Fundamental Consciousness of existence. This was considered later by him in the years 1990s in some published papers. In these papers it was recognized that the Fundamental Consciousness might emerge Itself from the existence, being before time in the deep existence. The Fundamental Consciousness, to be a consciousness, not only a feeling of existence, has still to have time, implying universes in Its own existence to develop phenomena of duration, when this seems necessary for It.

{n2} Accordingly, Fig.3 refers only to the contemporary science (of 1985) and not for a future science.

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14. Vezi Mihai Drăgănescu, *Profunzimile lumii materiale*, București, Editura Politică, 1979, p. 131-136. La p. 135 se arată: "Durata trebuie să apară atunci ca o proprietate similară continuificării, un fel de recordare (continuuificarea) a succesiunilor percepute de noi, căci fără durată cum ar putea să apară conștiința și mai ales creația? Afierea (ființarea) ca experiment ne apare atemporală, dar marcarea simbolului afirii apoi confruntarea acestuia cu faptul afirii ... sunt succesiuni care implică intervenția duratei ca o proprietate absolută, ca și aceea de a continua" Notăm că afierea este fenomenologică, în timp ce simbolul afirii este o structurare în sistemul nervos central.
15. Mihai Drăgănescu, op. cit., p. 137-138; 163-174; 197. In Glosarul de termeni, anexă la volumul aceluiași autor, *Știință și civilizație*, București, Editura științifică și Enciclopedică, 1984, afierea este astfel definită: "Fenomen de trăire. ființare, al oricărui organism viu. Este de natură fizică dar de o clasă diferită de celelalte fenomene materiale cunoscute până în prezent. El se petrece în informateria la care este cuplat orice organism viu prin introdeschidere. Afierea este un proces fizic de forma unul sens fenomenologic prezent la organismele unicelulare, plante și animale. Nu este gândire, este inconștientă, însă la organismele cu sistem nervos este sursa fenomenelor de conștiință și semnificație; la om este și sursă a vieții spirituale iar alături de viața socială este un factor determinant al conștiinței.  
Fenomenul primar de afiire determină în creierul omului o structură care simbolizează starea "a fi" (adică semnificația structurală neuronice "afi") iar confruntarea fenomenului de afiire cu structura neuronice pe care a generat-o duce la formarea unei alte structuri care simbolizează starea "a ști" (semnificația structurală neuronice "a ști"). În acest mod se constituie nucleul conștiinței-de-sine. Nucleul conștiinței-de-sine se reduce numai la ansamblul structurilor neuronice semnificative "a fi" și "a ști".  
Afierea este uneori înțeleasă, în general, ca fenomen de generare de sensuri fenomenologice în mintea umană. Atunci ea va fi deosebită de afierea primară descrisă mai înainte".
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