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Energy-structure invariant. Premises and essence

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The idea of mutual influence of the great geographic discoveries and modern physics is in general currency nowadays [1]. During the last five hundred years the basic stimulus to the development of contemporary physics is its drive for an absolute and everlasting control over nature. With the explosive development of technology in the XX century came the increasing shift towards solving of an engineer type of problems which in its turn gave notice for a crisis in paradigms [2]. The search for a way out of the contradictions and the blind alley leads to the creation of a phenomenal physics [3].

Space investigations combine the simultaneous use of micro- and macro approach to the study of the versatility of open systems in a broad range, specific periods, eigen energy, hierarchies [4]. A development of the concepts in real time is observed. Because of an increase in the dimension of the intensive structure formation, a necessity for description in a new state space occurs.

Beside this complexity comes the always present question about ambiguity: in classical physics these are the various types of instabilities; in quantum mechanics - Heisenberg's relations; in stohastic dynamics - the bifurcation region. An attempt for a clarification underlies the statement that human brain thinks in incomplete fuzzy codes and half-opened intervals with variably fixed boundary [5]. An attempt has been made for relating such ideas to quantum mechanics [6].

The area between the two poles of the abstract human knowledge - philosophy and mathematics - is now being filled by interdisciplinary manifestations/ displays of physical theories which converge to for analysis and diverge from for prognosis.

The development of processes in structured media is determined by energy. The modes of her movement are: dissipation, canalization, preservation, conversion. The energy exchange is mostly a chaotic cascade of constructive impulses or of ones destroying part of the system. The support of this structure depends on critical energy values for the corresponding levels. The scale of the system is also an energy function. Energetic changes can't exist without the existence of various types of energy - this being a basic fact in the second law of thermodynamics.

Time exists because of a change or of a comparison to an external for the system tact measure unit, out of this following the relativity of time.

The occurrence of structures in dissipative systems confirms the existence of an arrow of time [7]. Basic requirement in classic models is the cause and effect relations to stay unchanged and with maximum scope of action. In nature there are changes which are not continuous but an explosive ones [8]. The world nowadays is a set of relations between elements whose nature is determined by their relation to the whole [9]. From Bell's theorema follows that each structural level depends on the preceding one as well as on their organization [10]. There is a common implicit order of fundamental levels without their cutting off [11].

The complex adaptive systems bound in a common evolutionary process oscillate in a state of maximum information processing, suitability and evolutionary readiness [12]. In critical states they are characterized by reactions of medium capacity [13]. The problem of parting the boundaries and the contact between the systems is related to the "curse" of the boundaries. Local times and the media for whose structural levels exist various possibilities need to be known [14]. For the combination of the problem "infinity-boundary" Poincare suggests asymptotic coordinates, i.e., a new state space [15].

For the solution of the problem about the originating of the novelty, of an information in dissipative systems, specific relations between local information and the global entropy are suggested; it is believed that with the elapsing of time the state exchange of the information field tends to singularity, it is spoken about a collapse of the wave function [16].

A general question of every axiomatic is the relation of scales and periods of application. The terminological multi-semanticity is exemplified with the introducing of *simplexity* and *complicity* [17]. So far, equations, functions and operators are used, i.e., a balance and one-way action of causality. The mono causality in mechanics which determines its linear apparatus is shifted by Arnold's diffusion [18]. Linearity supposes repetition, eliminates the existence of disruptions and of the originating of something new. In a description using differential equations, problems arise with laws for preservation, limits of symmetry and the possibility for an unpredictable phenomena. The use of boundary and initial terms disregards the description of transitional areas. In our opinion the contradictions in linking of transitional areas is due to the use of discrete terms for

description of fuzzy phenomena. In the solutions of Navie - Stocks, in the system, with the elapsing of time problems become more complicated, peculiar areas appear in the state space [20]. In Xenon - Hillis' problem [21] with energy growing up "islands" of stability appear in the chaos. This is due to the time and again repetitions and changes in phase trajectory. The decrease of the periods of stability is related to the arising of new regimes.

In nature there are no peace, balance, average value, straight line. Anything being closed and isolated is an abstraction suited for approximation. In reality there are inner structural levels with shifting boundaries. There is a contradiction between the quantation of energy and the hierarchy of these levels, i.e., turbulency is macro-manifestation of the atomic structure [22]. Nature presents no requirement for harmony, i.e., phenomena are perceived as a sum of periodic processes because of unspoken presumption that there are alternative positive and negative changes in the energy exchange, discretisation of processes, recurrence, continuous motion, summing up. In fact the processes are non-linear, unbalanced, irreversible, multi-measurable [23]. New abstractions are needed beside the generally accepted which are efficient only in simple hierarchies.

When generalizing experimental data we found that there is a self-similarity between various natural phenomena. Without limiting the generality we can suppose that the evolution of the hierarchy of a system is determined by the spontaneous and momentary emergence of a new structure. In turbulent processes exists alternative interchange of local structures differing in size and instability. The participant random quantities are marked by the fact that their average value is lower than the average value of the boundary values of each of them. If we assume that the law for preservation is invalid, an avalanche-like explosion of disorder should follow and new definition of time and being will be necessary.

Systems are set up of two multitudes - energy and structure. Their elements are hierarchically included and not summed up or integrated. They exist in passive and active state. Their organization presupposes the presence if inner discretisation, i.e., of a boundary between the levels. The contradiction between the law for preservation of energy and the occurrence of a new state in self-organization we suggest to be avoided by introducing of an energy-structure invariant (ESI). It consists of energy, structure and generating potential (GP). It is introduced because of the unpredictability of the new phenomena and the openness of the systems. It is a continuous value, so it doesn't make sense to define it's velocity of dissemination, as well as it's critical value. In ESI energy is a value marking the completeness of the system; structure - the irreversibility of the transformations; the GP - the ambiguity. The law for energy preservation is generalized with the transformations of the components of ESI. The activation of the structure of the last hierarchic level creates a boundary region. It is defined as a phenomenological object inhibited for states. This contact between the systems is described not by "entry" - "exit", "summing up" - "balance" but

as an merging which results in loss of individualities. The development of the boundary region is marked by blurring the differences between the elements and structure multitudes. The birth of a new structure, i.e., the occurrence of a new information is realized when a maximum indefiniteness in the boundary region has been reached. This is called a delta-leap (DL). During DL only one possible state is realized which is not repeated in the same system and has not existed till the moment of the leap. DL is caused by a spontaneous, momentary activation of the generating potential. GP's action is enzyme-like and after the end of the DL the GP remains in a passive state, i.e., a new activation of the boundary region is blocked for an indefinite characteristic time. The presence of the GP in a passive state determines the detachment of structures from one another. So, the evolution of the structure-formation is a "mosaic" type of process. The thus described consecutive transformations of the components of the invariant form a cycle, i.e., the ESI exists because of performing, arranging and interaction of cycles. With an increase in their number, grows up the influence of the GP in the invariant because of it's probable accumulation in every delta-leap. The break in upon the aforesaid transformations creates various types of degenerated cycles.

For each cycle exist local time directions. During the DL occurs a disruption in the course of time. The configuration of this sequence could be described by a fuzzy fractal [24].

Assuming that there is no inner structure, follows the existence of a mega-system, of a perpetual energy and infinite number of simultaneous scenarios which is unlikely to be confirmed in the accessible experiments.

The axiomatic being created must be a hierarchical and evolutionary one. The presented propositions about the nature of the invariant can modify certain well-familiar mathematical techniques through the research of the GP. For example the mixed use of natural orthogonal functions and fuzzy fractals [25]; universal identification of classes in the renormalization theory whose critical exponents depend on the scale, the size, the governing structural parameters [26].

A generalized Hamiltonian could be created postulating of variable course of time, conversions between the non-commuting energy and structure and changes expressed through a boundary region and DL.

We can consider a wave-like process as a degenerated cycle - unlimited structure repetition without the action of a GP. If we assume the existence and lack of a delta-leap as presence and absence of structure levels, the configuration of the system can be described as a pack of longitudinal impulses.

Through using a specific logic of the sequence of the conditions we can make an elementary modelling if we use binary coding of the state of the components of the invariant.

A primary macro analysis of a system can be done using the relations between the specific energies and periods of/between the corresponding cycles.

The configuration of the system can be investigated by creating of state

space determined by the components of the invariant.

The use of fuzzy multitudes [27] doesn't contradict the second principle of thermodynamics and is suited for an heuristic activity including the use of technical devices.

The elaboration of a new mathematical apparatus needs time for an evolution of the new logic, for a comparison with classic techniques, development from the experiment, psychological training for its proper apprehension.

In conclusion we'll list several problems which are under discussion: the isolatedness of fundamental concepts; the emergence of an unique and stable solution from a number of unstable ones; the link between the measure of logic and the measure of the space about which it is postulated.

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Енергоструктурен инвариант. Предпоставки и същност

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(Резюме)

Представен е кратък коментар върху проблеми на някои физически парадигми. На тази основа са постулирани свойствата на предложен инвариант, базиран на пораждащ потенциал. Споменава се възможната му употреба за модифициране на някои математически техники. Предложени са няколко проблема открити за дискусия.