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THEORETICAL AND EXPERIMENTAL PHYSICS

ABOUT THE PRINCIPLE OF LEAST ACTION, THE CRISIS IN MODERN PHYSICS, THE PHYSICAL FOUNDATIONS OF QUANTUM MECHANICS AND THE STRUCTURE OF WATER

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A simple explanation of the numerous “anomalous” properties of activated - “structured” water in living systems and nonliving systems based on the principle of least action, classical nonlinear mechanics and electrodynamics is proposed; the causes of the crisis in modern physics, quantum mechanics are analyzed when considering the dynamics of dissipative, non-equilibrium, condensed media under conditions of nonlinear parametric resonance.

The principle of least action is one of the key provisions of modern physics. It underlies the equations, laws of physics, living nature, and is the most important among a family of extreme principles. All fundamental laws of interaction obey him. The principle of least action was formulated by Maupertuis in 1746 and further developed by mathematicians Euler, Lagrange and Hamilton. Maupertuis came to this principle from the feeling that the perfection of the Universe requires a certain economy in nature and contradicts any useless expenditure of energy. Natural movement should be such as to make some value minimal. It was necessary only to find this value [1]. And it was found - the action function S, the basis for the derivation of the equations of motion in the Lagrangian and Hamiltonian formulation of mechanics [2]. Action can be calculated for a completely arbitrary trajectory, no matter how “wild” and “unnatural” it may be. Among the entire set of possible trajectories, there is one single, extreme, along which the body really goes. The principle of the extremality of the action function gives the answer to the question of how really the body will move economically. All living and non-living things in Nature and the World around us live by the principle of least action - optimally and extremely. The deviation from this principle of individuals, objects and subjects leads to chaos, destruction and jump from one steady state to another. So there is an evolution and revolution in nature and society.

Recently it has become clear that our world is stable due to nonlinearity and resonance has turned out to be the most stable state in nature. Unfortunately, most associate resonance with destructive power, with the exception of a few specialists (radio physicists, mechanics, physicists, biologists). Mathematically rigorous evidence that resonance is the most stable state of motion in

nature follows from the principle of least action and the works of Poincare A., Lebedeva P. N., Ovenden M. V., Chetaeva N. G., Blekhman II, Shironosov V. G. ... [3].

The origins of the crisis that has arisen in modern society and in science when interpreting unusual observable phenomen [4] are in the “linearization” of reality surrounding us, in the history of the development of modern physics. In fact, the development of physics began with the study of nonlinear equations - the famous Kepler problem. The Kepler problem contains typical attributes of a nonlinear oscillatory system with parametric resonance: the dependence of the period of revolution of the planets around the Sun on the orbital parameters. But due to the complexity of solving nonlinear equations and the absence of an explicitly small parameter, the subsequent development of theoretical and experimental physics followed the path of constructing linear phenomenological physical theories: the theory of elasticity, electromagnetism, problems of retaining bodies and particles outside the zones of parametric resonance, quantum mechanics and quantum field theory. The linearization of nonlinear equations led to their decomposition into infinite series in a small parameter. The standard way to solve them, by cutting off the number of decomposition terms under consideration, led to the erroneous conclusions when interpreting the observed nonlinear phenomen. In particular, when developing and creating atomic traps by foreign authors who were awarded the Nobel Prize in 1989, the erroneous conclusion was drawn retention of bodies and particles in the zones of nonlinear parametric resonance. Unlike foreign authors, in Russia, back in 1974-1977, it was demonstrated theoretically and experimentally (for macro-bodies) the possibility of selective spatial retention of bodies and particles (from elementary to macro) in non-uniform resonant electromagnetic fields without external feedback [5, 6, 7]. Later, a method was developed that allows analytically, with the necessary degree of accuracy, to find the regions of dynamic stability of unstable states in statics of complex multicomponent nonlinear systems of a physical nature outside and under nonlinear parametric resonance (1988) [3, 8, 9].

It took quite a lot of time (from the XVII to the XXI century) before it was proved that when calculating and deriving equations describing the nonlinear world and the phenomena surrounding us, taking into account only the terms in interactions like Coulomb, gravitational ~ $\mathbf{1/r}$ and centrifugal ~ $\mathbf{1/r^2}$ obviously not sufficient, and the linearization of the equations is clearly erroneous [3]. Modern "linear" physics has not coped with the description of the nonlinear world. Scientists, in solving and deriving equations to explain the problems that have arisen, have splashed out "child" (classical nonlinear mechanics and electrodynamics) and subsequent terms in the expansion ~ $\mathbf{1/r^3}$ (such as dipole - dipole). A gap appeared - a “black hole” that swallowed up hundreds of thinking, advanced scientists and works, and a description of the discreteness of the

world around us appeared on the basis of only the phenome logic approach, including on the basis of the Schnedinger phenome logic equation and quantum mechanics.

The missing terms in the equations ~ $\mathbf{1/r^3}$ and the principle of the smallest action of extremes of resonant states of motions allowed to explain not only the majority of the observed "anomalous" properties of activated water in living and nonliving systems, but also to prove the discreteness of the world around us based on nonlinear classical mechanics that a system of two dipoles (electrical, magnetic ...), unstable under static conditions, becomes stable at resonance and leads to the discreteness of nonlinear dynamic systems [3, 10].

In the last century, two fundamental works, Gulak Yu. K. and Chetaeva N. G., went unnoticed. The authors derived «the Schrödinger» phenomenological equation for physics [11] and for celestial mechanics [12] on the basis of classical nonlinear mechanics. "... Whenever we approach the explanation of certain phenomena of nature by the methods of classical mechanics, we must not forget that in reality no phenomenon is presented in its pure form. No matter how precise the forces acting on the material system are, they will always remain unaccounted for some minor disturbances. The latter, however small, affect the movement of the material system, in particular, if the movement is unstable. Only stable movements, and the poet Thom only they more or less correctly describe the real movements "([11], p. 243, 1929). This clear principle of the stability of real motions, brilliantly proven in many basic problems of celestial mechanics, unexpectedly allowed the author [11] to obtain a picture of almost quantum phenomena for mechanical dynamical systems. After simple calculations, based on two provisions that:

(I) *some movements in nature are the most prominent in terms of sustainability;*

(II) *there are in reality minor disturbances;*

Chetaev N. G. received [11] the basic equation of "permitted orbits" in the form:

$$\Delta\Psi+2(U-h)\Psi+(\Delta A/A)\Psi=0 \qquad (1)$$

where $\mathbf{H=T-U}$ - Hamiltonian function corresponding to the material system, and $\mathbf{A^2=\Psi\Psi^*}$ is the density of the trajectories at an arbitrary point in the phase space.

"If $\Delta\mathbf{A=0}$, then the basic equation" (1) "takes the form of a differential equation put by Schrödinger into the basis of its so-called wave mechanics" [11].

The solution of the differential equation (1) can exist only for some specific values of **h**. The set of values of **h** for which this is possible is called a spectrum [1].

"We think of a material system moving under the influence of some forces in a minor field of disturbance. This last destroys any movement, unless it is stable and legal. Thus, stable, legal

movements are preserved. The movements of the material system occur in a fairly small area, enveloping a stable trajectory" [11].

The principle of extremal stability of nonlinear dynamical systems at resonance, arising from the extremality of the S-function, gives a simple explanation of the first postulate of Chetaev in the derivation of the "allowed orbits" equation. It follows from it that of the whole variety of motions observed in nature - the resonant states of motion are the most stable. As a result, due to the presence of a chaotic background of the perturbation fields, a natural selection of the most stable - discrete resonant states of motion occurs. Over time, as material systems move in phase space under the influence of disturbance fields, bifurcations arise according to the Poincaré scenario [13, p. 75]: The principle of extremal stability of nonlinear dynamical systems at resonance, arising from the extremality of the S-function, gives a simple explanation of the first postulate of Chetaev in the derivation of the "allowed orbits" equation. It follows from it that of the whole variety of motions observed in nature - the resonant states of motion are the most stable. As a result, due to the presence of a chaotic background of the perturbation fields, a natural selection of the most stable - discrete resonant states of motion occurs. Over time, as material systems move in phase space under the influence of disturbance fields, bifurcations arise according to the Poincaré scenario [13, p. 75]:

(I) *periodic solutions are the only gap through which we could try to penetrate an area that was considered inaccessible ";*

(II) *"a periodic solution can disappear only by merging with another periodic solution (periodic solutions disappear in pairs, like the real roots of algebraic equations)";*

which in turn leads to chaos and further to the transition to new stable resonant states of motion - to the evolution of dynamic systems [3, 11-16, 21]:

Currently, there is an explosive interest of scientific, political and public just for “activated water”, “physicochemical ideas about the structure, memory and mechanisms of energy-information changes in water properties, changes in the structural state and biological properties of water under the influence of various energy-information effects” [4, 17, 19].

The terms “activation,” “structure,” and “anomalous” properties of water have become common nouns, often occur and have become firmly established in the publications and statements of various authors. Attempts to explain the “anomalousness” of the properties of “activated”, “structured” condensed and aerosol media in non-equilibrium thermodynamic states based on linear and phenomenological theories led to a “crisis” and to a “revolutionary” situation in the minds of many scientists and the public and to create scientific and public commissions to combat

“pseudoscience” [4]. Only a few managed to reconsider their views and “look at the problem from above”, understand and realistically assess the situation that has arisen with water. Finally, we realized that we know almost nothing about water [17, 19], but also about nonlinear physics [3, 11, 12, 21]. “Consequently, this is a huge step, because after this understanding comes the desire to know” [17].

The main reason for the situation when interpreting the “anomalous” properties of “activated” - “structured” water in living and nonliving systems [4] was that they threw out the “child” with water, “not seeing the forest because of the trees” - nonlinear parametric resonance.

At one time, A. L. Chizhevsky suggested, and then in the course of numerous experiments it was confirmed, "... that the corresponding physical impact can be distorted by the structure of water without changing its chemical composition and without changing the usual physical conditions of its existence. Changing the properties of water, not which entails neither a change in the usual conditions of its existence (temperature, pressure, etc.) nor the slightest change in its chemical composition is called activation. Those properties of water that depend on its structure easily violate I influence of cosmic forces. In fact, to change the structure of water and, consequently, a change in its delicate properties, is required, as it turned out, a very small amount of power "[18].

The uniqueness of the properties and the simplicity of obtaining activated liquids (liquids converted to a non-equilibrium thermodynamic state with dissipative structures) with relaxation times from 10-12 seconds to several days or more ensured their widespread use throughout the World in various fields and technologies. Translation of liquids into a thermodynamically no equilibrium (activated) state, as experience has shown, can be carried out by means of substances, fields, currents, including those based on chemical and biochemical reactions, both by contact and by non-contact method [3].

Separate attempts to explain the unusual properties of water on the basis of quantum mechanics by the appearance of coherent domains in water [19] were not crowned with the success of universal acceptance [20].

Let us try to understand the maelstrom of events and the root causes that led to antagonism and stratification in society and science in explaining the anomalous properties of “activated” water.

Therefore, let us take the definition, and for brevity, by the term activation of liquids, we mean their transfer to a thermodynamically no equilibrium state with dissipative structures. No one denies the fact of the existence of a natural phenomenon — the occurrence of localized (two

and three-dimensional) dissipative structures — ball lightning, solitary vortices in the atmosphere, but most consider that a similar phenomenon of the occurrence of localized dissipative three-dimensional structures in liquids is impossible!

Perhaps, and this is obvious [3, 7, 8, 21]. In science, this is the case. In the beginning - this cannot be!? Then - m ... yes, maybe?! In the end - well ... it's ... obviously, it's just ... just!!! In solving the “anomalous” properties of activated water, as well as in the cases with “anomalous” phenomena - “ball lightning” [22], “levitation” (dynamic stable retention of bodies and particles under non-linear parametric resonance without feedback), including for atomic traps [3, 5-10, 14-16], the resonance again helped.

January 4, 2012, 121 years old from the date of writing P. N. Lebedev's program of work on the essence of molecular forces [23]. At the center of the program was the question of the electromagnetic effect of waves on resonators. “We have to say”, he wrote, “that between two radiating molecules, like between two vibrators in which electromagnetic oscillations are excited, there are ponderomotive forces.”

The physics of the processes of the "anomalous" properties of activated water in living and nonliving systems is complex, but, in general, is understandable. Dipole water molecules and ions, when activated, form vortices of dipoles synchronously oscillating in antiphase ensembles, dipoles, peculiar molecular “tuning forks” - Resonant Microclusters (RM). In statics, such systems of dipoles (electric, magnetic, nuclear) are unstable (the effect of collapse or expansion), but in the dynamics, at resonance, the effect of dynamic stabilization of unstable states is manifested. The alternating electromagnetic field from two synchronously oscillating dipoles has a narrow frequency spectrum of $\sim 10^{-(13\text{-}23)}$ (supercoherent radiation, resonant effect) and decreases $\sim 1/r^n$ ($n>3$). In this case, contact and non-contact activated liquids that are at room temperature result in solitary vortices (three-dimensional non-equilibrium dissipative resonant structures) [21]. The "effective temperature" in such vortices is millions of degrees and their lifetime is tens, hundreds of seconds, minutes and years, depending on the mode of resonant microclusters. The mechanism of the appearance of solitary vortices in activated liquids (Fig. 1) [24] is similar to the mechanism of excitation of ball lightning ("ball-light") in the air [3, 22]. In general, when liquids are activated, it is more correct to talk about dissipative structures, “vortices” that occur in water, and not about “structured” water.

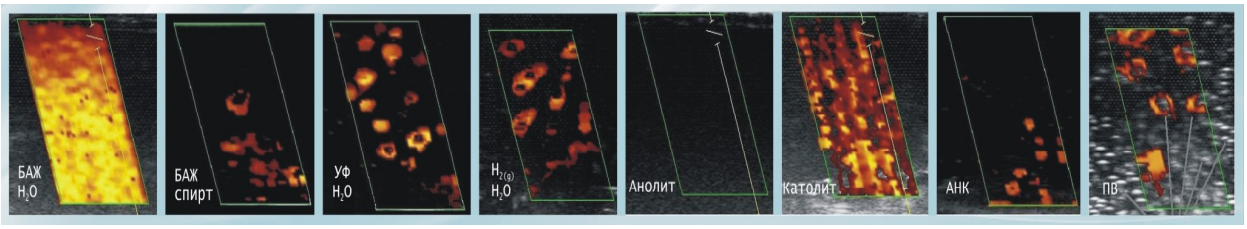

Fig. 1. Detection of resonant microclusters in activated aqueous solutions [24].

Electromagnetic supercoherent radiation (SR) arising in activated fluids from RM has rather unique properties:

- extends almost without loss over long distances;

- selectively penetrates metals;

- has a super-powerful effect on biological systems with its long-term super-weak effect (resonance effect, energy storage by an ultra-good system);

- has a narrow frequency spectrum (resonance effect) and decreases ~ 1/rn (n>3).

In general, the human body is a highly complex nonlinear dynamic system that is in a state of resonance, and consists of molecules, atoms, organs, resonantly interacting with each other. It seems that the most important factor in this process is the activation of aqueous solutions and the formation of PM. RM is synchronized with each other and is the basis of energy, immunity of the human body.

P.S. Simple truths, the state and relevance of non-linear problems.

1. Resonance is the most stable state of motion in nature. Resonance mechanisms, devices and resonant technologies have efficiency. ~ 100% and are the most optimal and promising in physics, chemistry, biology and medicine for technology and production.
2. At resonance, the system, including the living and inanimate, radiates minimally and stores energy as much as possible. Under resonance conditions, minimal energy costs are required to destroy or stabilize the system.
3. Evolution occurs through the transition from one resonant state of motion to another under the influence of external disturbing factors. Chaos and periodicity are two sides of the same phenomenon - evolution and time.

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