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ACOUSTICS OF IMPACTS AS A FACTOR OF ENSURING MUTATIONAL AND EVOLUTIONARY TRANSFORMATIONS OF THE ENVIRONMENT

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***Abstract**: Within the framework of the conceptual approach, taking into account the previously unknown, first identified by the authors features of the conditions of the internal energy equilibrium of material media (between their different physical nature energy states), the real contribution of acoustic disturbances experienced by media in the conditions of existence into ensuring of their and of the material world as a whole mutational and evolutionary transformations is taken into account and confirmed.*

***Keywords:** Acoustic pollution, acoustics of the conditions of existence of media, acoustic disturbances, instability of charge distribution over the volume*

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1. INTRODUCTION

Even now, the solution of a number of extremely important, fundamental and even applied problems related, for example, to climate warming or ecology, cannot be provided (or, at least, is restrained), including due to the detected insufficiency of basic ideas about the factors of influence and mechanisms for ensuring mutational and evolutionary transformations of the material environment.

It should be noted that the proper justification of the mechanisms for ensuring the mutational and evolutionary nature of transformations in nature on a traditional physical basis has not yet been formulated.

This work is primarily aimed at justifying the expediency of using, including those that go beyond the framework of generally accepted physical security to solve the problem thus being detected.

The is based mainly on the use of the authors' research materials as a scientific reserve [1- 9]- and, in this regard, is, in essence, their continuation and further logical development.

2. ARTICLE

2.1. Formation of the approach

There are known works that substantiate, for example, the existence of previously unknown generation mechanisms in the composition of weakly ionized plasma media of macroscopic spatially charged formations (aquasneutral or AQN-formations) and establish previously unknown features of their internal energy equilibrium (UVER-between energy states of different physical nature) in their composition [1-9], indicating, among other things, the ability to provide the process of mutation of chemical and isotopic compositions of a wide range of material media with charge acoustic effects.

There are known works that substantiate, for example, the existence of previously unknown generation mechanisms in the composition of weakly ionized plasma media of macroscopic spatially charged formations (aquasineutral or AQN-formations) and for the first time establish previously unknown features of the internal energy equilibrium conditions (IEEC--between energy states of different physical nature) in their composition [1-4].

Moreover, by the works, with account of IEEC, at the first time experimentally justified the possibility of excitation by charge impacts of acoustic origin, including and of neutron--forming reactions intra-nuclear origin and being caused by the processes mutation of a wide nomenclature of material media (from the number of used in research, regardless of the composition) [5-9].

Nevertheless, it should be recognized that the collectively noted materials are still insufficiently distributed and have not passed the necessary discussion in the scientific community. It seems obvious that for their effective use in the framework of the task formulated in the work, they thus require additional clarification and discussion.

2.2. Acoustics of impacts and AQN-formations

Let us show, first of all, that to a large extent, regardless of the nature of the impact, the acoustic nature of its manifestations can lead to the formation of AQN-formations in the composition of the medium.

We will use a three-liquid plasma model, in frame work of the which the medium is considered as a low-temperature thermodynamically open plasma system-a mixture of neutral (a), as well as positively (i) and negatively charged (e) components, the composition of it is collectively determined by the traditional conditions of ionization equilibrium and, at the same time, the results of the interaction of the system with the environment [1].

As the state parameters we will use the degree of ionization

$$\alpha^* = \frac{p_i^*}{p_a^{(0)}} = \frac{n_i^* kT}{n_a^{(0)}} = \frac{n_i^*}{n_a^{(0)}} \tag{1}$$

and the relative content of the excess electronic component

$$\eta = \alpha(1+\psi), \quad \psi = (n_e - n_i)/n_i \tag{2}$$

The equations of relations of parameters corresponding to (1) and (2) acquire In this case the form

$$\left.\begin{array}{c} n_i^* = \alpha^* n_a^0 \\ n_e^* = \alpha^*(1+\psi) \\ n_a^* = (1-\alpha^*)n_a^0 \end{array}\right\}, \quad \left.\begin{array}{c} p_i^* = \alpha^* n_a^0 kT \\ p_e^* = \alpha^*(1+\psi)n_a^0 kT \\ p_e^* = (1+\psi)n_a^0 kT \end{array}\right\} \tag{3}$$

The pressure and concentration of the particles of the initial composition of the medium correspond to the relations

$$P_\Sigma = \left(1+\alpha^*(1+\psi)\right)n_a^* kT, \quad n_a^0 = P_\Sigma/[(1+\alpha^*(1+\psi))n_a^* kT] \tag{4}$$

2.3. Graphic text editing

Into the system of equations for the description of plasma states

$$n_e m_e\left(\frac{\partial}{\partial t} + \overrightarrow{U_e}\nabla\right)\overrightarrow{U_e} + \frac{en_e}{\mu_e}\left(\overrightarrow{U_e} - \overrightarrow{U_a}\right) + \nabla p_e - en_e\overrightarrow{E_\Sigma} = 0 \tag{5}$$

$$n_i m_i\left(\frac{\partial}{\partial t} + \overrightarrow{U_\iota}\nabla\right)\overrightarrow{U_\iota} + \frac{en_i}{\mu_i}\left(\overrightarrow{U_\iota} - \overrightarrow{U_a}\right) + \nabla p_i - en_i\overrightarrow{E_\Sigma} = 0 \tag{6}$$

$$\overrightarrow{U_\Sigma} = \frac{m_e\overrightarrow{U_e}\eta + m_i\overrightarrow{U_\iota}\alpha + m_a\overrightarrow{U_a}(1-\alpha)}{m_e\eta + m_i\alpha + m_a(1-\alpha)} \tag{7}$$

$$\rho_\Sigma = \frac{m_e\eta + m_i\alpha + m_a(1-\alpha)}{1+\eta}\cdot\frac{P_\Sigma}{kT} \tag{8}$$

$$\frac{\partial}{\partial t}\rho_\Sigma + \nabla\cdot\left(\rho_\Sigma\overrightarrow{U_\Sigma}\right) = 0 \tag{9}$$

$$\frac{\alpha\eta}{(1-\alpha)(1+\eta)} = 6.666798\cdot 10^{-2}\frac{T^{5/2}}{P_\Sigma}\exp\left(-\frac{eV}{kT}\right) \tag{10}$$

$$\frac{\partial}{\partial t}q + \nabla\cdot\overrightarrow{J_k} = 0 \tag{11}$$

$$\nabla\cdot\vec{E} - \frac{1}{\varepsilon_0}q = 0 \tag{12}$$

were being included the equations of motion electronic (5) and ionic (6) component; according to the mass average velocity (7) and density (8); the equation of continuity of flow (9), the equation of ionization equilibrium in the form of Sakha taking into account the involved constants represented in the form (10), the equation of charge conservation (11) and, finally, the equation for the electric component of the field (12).

Used in the system $\vec{E} = \vec{E}_{int} + \vec{E}_{ext}$ - the electric field strength in the plasma, where , $\vec{E}_{int}, \vec{E}_{ext}$ - internal and external components.

Taking into account the relations between the parameters, the system (5)-(12) is reduced to eight linearly independent relations between ten functions: $\mathbf{U_e}, \mathbf{U_i}, \mathbf{U_a}, \boldsymbol{\rho_\Sigma}, \mathbf{U_\Sigma}, \boldsymbol{\alpha}, \boldsymbol{\eta}, \mathbf{E}, \mathbf{P_\Sigma}, \mathbf{T}$.

2.4. Machine experiment

The system in the one-dimensional representation was used to identify the general features of the states of weakly ionized plasma media under conditions of developed space-time parametric nonstationarity.

The closure of the system was provided by the assumptions that

$$P_\Sigma = p_0\left[1 + c\cos\left(\frac{2\pi n_1 f_0}{a_0}x\right)\sin(2\pi n_1 f_0 t)\right]; E_{ext} = 0; T = T_0\left(\frac{p}{p_0}\right)^{\frac{n-1}{n}} \tag{13}$$

or, taking into account the variability of the nature of the effects, the

$$P_\Sigma = Const; E_{ext} = 0;, T = T_0\left[1 + c\cos\left(\frac{2\pi n_1 f_0}{a_0}x\right)\sin(2\pi n_1 f_0 t)\right] \tag{14}$$

Finally, the option was used when it was assumed that

$$P_\Sigma = Const; T = Const; E_{ext} = E_0\left[1 + c\cos\left(\frac{2\pi n_1 f_0}{a_0}x\right)\sin(2\pi n_1 f_0 t)\right] \tag{15}$$

The task was to integrate the system in the field of

$$x \in [0, m_x x_k], t \in [0, m_\tau t_k](x_k = a_0/(n_1 f_0), t_k = 1/(n_1 f_0))$$

under the initial conditions corresponding to the physical meaning:

$$x = 0 \vee t = 0: U_e = U_i = U_a = U_\Sigma = U, E_{int}$$

The basic parameters (p_0, T_0, V, U, c, n_1) widely varied.

2.5. Overall results

As expected, regardless of the nature of the considered manifestations (corresponding to (13), (14) or (15), their impact on the environment necessarily determines the formation of AQN - formations in its composition. Moreover, the general nature of the AQN formations registered in this case does not reveal also of any significant differences in relation to those detected earlier (see, for example, [1], [4]) and can be represented in the same way (see, Fig. 1, 2).

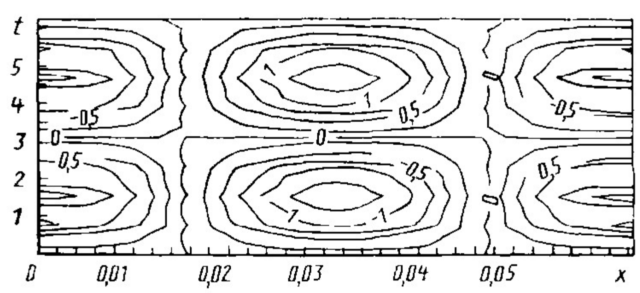


Fig. 1: Space-time dependence of the primary disturbances: p=-f(x,t): p, MPa; t, 10^{-5} s; x, m

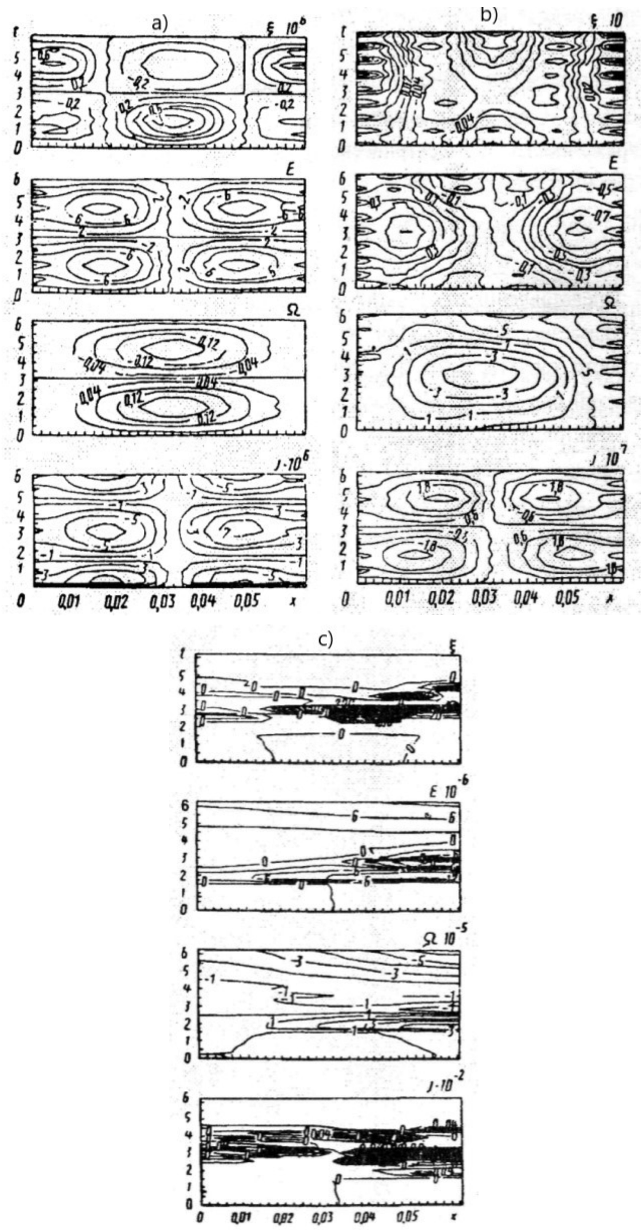


Fig. 2: S Characteristics of AK-formations. Conditional compositions: V=12, 16, 14 V (a,b,c, respectively)

Their general characteristics, in this regard, are not also subject to any restrictions within the framework of the concept of „quasi-neutrality" and indisputably indicate that, in essence, regardless of the origin, acoustic influences on the plasma medium can lead to the development of instabilities in the distribution of electric charge over the volume, thus ensuring the formation of AQN-formations in its composition.

In the framework of this work, we limit further consideration of the manifestations of the acoustics of excitations, noting, however, once again that the development of a particular charge instability in a plasma medium necessarily determines the formation of fluctuating AQN formations in its composition.

3. THE INTERNAL ENERGY EQUILIBRIUM CONDITIONS (IEEE]

As expected, the results of the experiment confirmed that, regardless of the origin, acoustic effects on the plasma medium can lead to the development of instabilities in the distribution of electric charge over the volume of the medium and thus ensure the formation of AQN-formations in its composition.

To confirm the possibility of providing by charge influences for mutational and evolutionary transformations of material media, regardless of their phase state, we turn once again to the consideration of previously unknown, but now already established by the authors [1-9], conditions of their internal energy equilibrium (IEEC).

3.1. Small perturbation method

For consideration, we select a certain thermodynamically open volume of the medium, the composition and state parameters of which correspond to the relations (1)-(4). Let us assume that by external influences in relation to the allocated volume of the medium, an excess electric charge is introduced into its composition and then retained.

Naturally, the internal equilibrium of the medium in this case, as corresponding to the minimum of its thermodynamic isobaric-isothermal potential "", is determined by the expression:

$$\delta\boldsymbol{\Phi} = \sum_{1}^{j}\left(\frac{\partial\boldsymbol{\Phi}}{\partial N_j}\right)_{\bar{p},\bar{T}}\left(\frac{\partial N_j}{\partial\psi}\right)_{\bar{\alpha}^*}\delta\psi + \sum_{1}^{j}\left(\frac{\partial\boldsymbol{\Phi}}{\partial N_j}\right)_{\bar{p},\bar{T}}\left(\frac{\partial N_j}{\partial\alpha^*}\right)_{\bar{\psi}}\delta\alpha^* =$$
$$= \sum_1^j \mu_j\left(\frac{\partial N_j}{\partial\psi}\right)_{\bar{\alpha}^*}\delta\psi + \sum_1^j \mu_j\left(\frac{\partial N_j}{\partial\alpha^*}\right)_{\bar{\psi}}\delta\alpha^* = \mathbf{0}\ . \tag{16}$$

Here

$\boldsymbol{\mu}$ – is the chemical potential of the j-th component of the medium (***j*** **=*a, e, i***).

Note that for $(\Delta n_q = n_e{}^* - n_i{}^* = \mathrm{const})$, the parameter $\psi = \frac{n_e{}^*-n_i{}^*}{n_i{}^*} = \frac{\Delta n_q}{\alpha^* n_a{}^{(0)}} = f(\alpha^*)$ and the first term (16) are identically zero. The expression (16) thus reduces to the equation

$$\mu_i\delta N_i + \mu_e\delta N_e + \mu_a\delta N_a = 0 \tag{17}$$

and taking into account $\delta N_e \approx (1+\psi)n_a{}^{(0)}\delta\alpha;\ \delta N_i \approx n_a{}^{(0)}\delta\alpha;\ \delta N_a \approx -n_a{}^{(0)}\delta\alpha$ is reduced to

$$\mu_i + \mu_e(1+\psi) - \mu_a = 0 \tag{18}$$

The expression (18) is thus reduced to the dependence

$$\prod_j p_j{}^{c_j} = \prod_j\left[g_j\frac{(2\pi m_j)^{3/2}(kT)^{5/2}}{h^3}\right]^{c_j} exp\left(-e\frac{V-\psi\Omega}{kT}\right), c_j = \begin{cases} 1, if j = i, \\ (1+\psi), if j = e, \\ -1, if j = a. \end{cases} \tag{19}$$

and, in disregard of second-order quantities of smallness, corresponds, for example, to the expression

$$\frac{p_i{}^* p_e{}^{*(1+\psi)}}{p_a{}^*} = \frac{g_i}{g_a}\left[g_e\frac{(2\pi m_e)^{3/2}(kT)^{5/2}}{h^3}\right]^{(1+\psi)} exp\left(-e\frac{V-\psi\Omega}{kT}\right), \qquad (20)$$

Here

V – the ionization potential of the medium, determined in the usual way;

Ω - the electric potential of space, determined by the negative work produced by the medium itself by introducing an excess charge into its composition.

3.2. The general nature of the internal equilibrium

In deducing (19), (20) we assumed that inner equilibrium distribution by carrying in system's composition of surplus charge is necessarily suppressed with reaction $A \Leftrightarrow A^+ + e$ kind. However, the noted is not having one.

Indeed, "from all possible steady states of thermodynamic system being showed with border conditions of the law of mass transfer and conversation along with 2nd law thermodynamic the state with minimum production of entropy is realized, to say, that which is priority one [10].].

Let's assume that the priority reaction formed in the system as a response to a disturbance is a reaction of the type $AB \Leftrightarrow A + B$. If the work on the system for introducing a charge into its composition (or the formation of electric field sources in the medium due to deformation, for example, of its crystal lattice) is determined by the level $\delta L = \mu_e \delta N_e,$, then the equilibrium of the system will meet the condition

$$\mu_{AB}\delta N_{AB} + \mu_A \delta N_A + \mu_B \delta N_B + \mu_e \delta N_e = 0 \qquad (21)$$

and can be used to find relations that meet the conditions of internal energy equilibrium.

Now, if - the relative molar contribution of the charge component to the relaxation reaction $\psi=\delta N_e/\delta N_{ab}$ and take into account that $\delta N_{ab} = -\delta N_a = -\delta N_b$,then, in disregard of the second-order quantities of smallness (21), it is reduced to the form

$$\prod_j \chi_j{}^{c_j} = \prod_j K(T)_j{}^{c_j} exp\left(-\frac{\varepsilon_{act} - e\psi\Omega}{kT}\right), c_j = \begin{cases} 1, if j = AB, \\ \psi, if j = e. \\ -1, if j = A, B. \end{cases} \qquad (22)$$

Here

ε_{act} – the activation energy of the association reaction (or any other one that is given priority in the specific conditions of the system

X_j – the molar contents of the j-th fraction in the system.

Ω – the electric potential of the space, the level of which can be determined, for example, by the least positive work produced by external influences on the introduction of an excess charge into the composition of the AQN-formation.

4. PRELIMARY DISCUSSION OF THE RESULTS

Note that the dependencies (19), (20), (22) correspond to the content of the law of active masses and thus discover that with respect to localized AQN-formations, temperature ***T*** , as a traditionally estimated parameter, directly determines the equilibrium populations only of the mechanical nature of their energy states. If, within the framework of the traditional description, we introduce T_{exc} * - the excitation temperature of chemical bonds and electronic energy states of the level, then its relationship with ***T*** - the excitation temperature of mechanical (translational, vibrational, rotational) energy states of the medium (conditionally translational) is determined by the dependence

$$T_{exc} *= T\frac{\varepsilon_j}{\varepsilon_j - e\psi\Omega}, \qquad (23)$$

indicating the admissibility of significant differences between them: T_{exc} *>>***T*** (or even T_{exc} *<***0***) at $\varepsilon\psi\Omega>0$, or, on the contrary, at $\varepsilon\psi\Omega<0$, T_{exc} *<***T***

IEEC in the form of (19), (20), (22) indicate so the existence of a traditionally ignored (unknown) channel for controlling the states of material media, the role of the control factor in which the electric charge plays.

According to (23), the function $T^*_{exc}=f(\varepsilon\psi\Omega)$ may undergo rupture type (∞ , -∞), or (-∞ , ∞) meet, as one might expect, most favorable conditions for the excitation of the medium composition AQN-education instabilities its atomic and molecular structure. In this case, it is reasonable to expect that their development can lead to a violation of chemical bonds in the composition of the AQN-medium, loss of stability of electrons in orbits, electron departures from orbits, and even absorption by their nuclei with subsequent neutron formation (analog ***K***- or ***e***- capture), that is, accompanied by a very diversity complex of manifestations that does not exclude the excitation of energy-producing reactions of intra-nuclear origin in the composition of the AQN-formation. The latter, however, requires experimental confirmation.

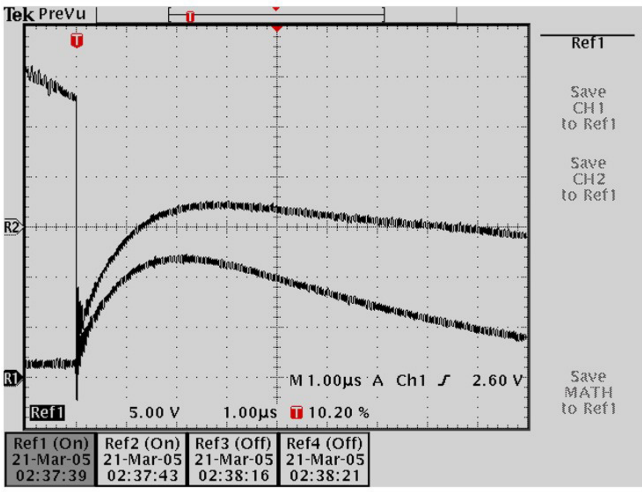
5.EXPERIMENTAL IMPLEMENTION

The experimental setup included: - a reactor-a quartz glass vessel equipped with the main electrodes; a system for storing and preparing the medium; a system for input/output of the medium to / from the reactor (a); an energy supply system; a system for recording process parameters. It was noted that an excess charge in the reactor environment can be formed, for example, by a pulsed discharge of a capacitor. The power supply source, taking this into account, included a capacitor with a capacity of 2.0-2.5 uf, which, through the current-limiting resistance, could be discharged through the medium in the reactor. The potential difference on the capacitor plates was limited to the range of 0.8-1.5 kV.

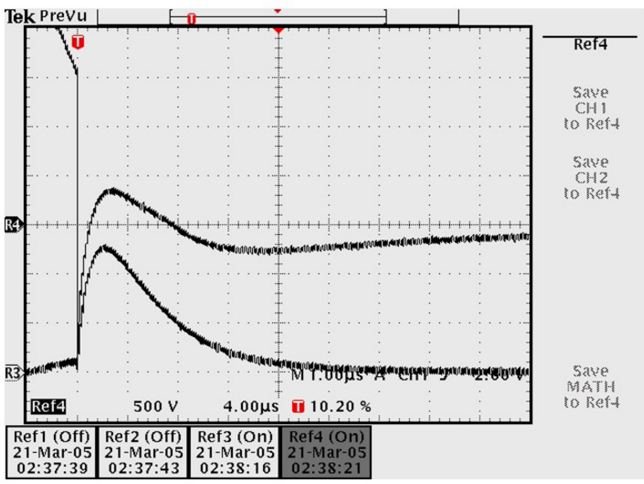
During the research, the reactor was placed in a capsule with hollow walls made of stainless steel sheet that separated the working space of the reactor compartment. The distance of the sheets of each of the six walls of the capsule from each other is about 250 mm. The source of excitation of pulsed effects on the medium under experimental conditions included a 2.2 UF capacitor, which, through a current-limiting resistance of 2.5 Om, could be discharged when the breakdown voltage was reached through the medium in the reactor.

5.1. Results

Fig. 3 shows typical experimental waveforms of voltage and current at the discharge gap of the reactor, which meet the conditions for the excitation of mutation processes of chemical and isotopic compositions of various media by charge acoustic effects. The waveforms meet the conditions for the excitation of mutational processes in the media of hydrogen, nitrogen, air, helium, and a nitrogen-hydrogen mixture (at a molar ratio of 1/1).



(a)



(a)

Fig. 3: Typical Discharge at pressures 1.0-2.0 Torr Scanning: up to 1 µs / div -a; up to 4 µs / div- a

In relation to the conditions for obtaining waveforms, Fig. 1, the application of the field to the medium and the launch of the oscilloscope for registering the discharge were activated simultaneously using an electronic key included in the discharge circuit of the reactor.

For all of the above-mentioned media nomenclature, 100-200 events were recorded by the DKS-96N dosimeter-radiometer near the reactor (at a distance of 0.5 m) under discharge-specific conditions. Neutron radiation was detected in this way at distances up to 10 m from the discharge node.

To verify the nature of the radiation and exclude the possibility of distortion of the results due to the effects of any interference on the detector, the following experiments were conducted. A similar c block with a remote scintillation target was installed next to the detection unit. This block did not register events during the discharges. In addition, the hollow walls of the reactor compartment capsule were filled with a neutron absorber-a saturated solution of boric acid. The introduction of an absorber between the discharge node and the detector led to a sharp attenuation of the recorded events (by an order of magnitude). In studies with empty chamber wall cavities or even filled with tap water, no attenuation of the radiation flux was observed.

The results of verification, thus, with a high degree of confidence indicate in favor of the excitation of neutron-forming reactions under experimental conditions, that is, reactions of intra-nuclear origin, including those that actually provide mutational transformations of the chemical and isotopic compositions of media (from the nomenclature used in this case).

6. CONCLUSION

With presented results of theoretical and experimental studies with a high degree of reliability substantiated the possibility of excitation of a particular nature by acoustic influences in a wide range of material media (at least among of used in the work), including neutron-forming reactions of intra-nuclear origin, which really are able to provide of mutational, and in relation to natural conditions, and of evolutionary character transformations of the chemical and isotopic compositions of the structural components of the material world.

As a remark

It should be noted that the results presented in this paper already at this stage strongly suggest that relaxation processes in the environment of AQN-formations formed in the atmosphere under the influence of, for example, powerful electromagnetic radiation, best contribute to the development of instabilities of the atomic-molecular structure in its environment, providing the possibility of excitation in the atmosphere under these conditions, including previously (unknown) energy-producing reactions of, consequently, the ecosystem of the Earth as a whole, although difficult to predict in scale, but undoubtedly, including a negative impact.

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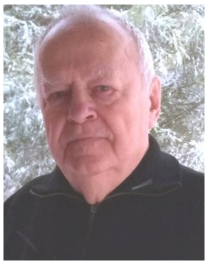

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