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# PHYSICAL AND MECHANICAL DESIGN OF VIOLATIONS OF CONFORMATION localized cell membranes of higher plants

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*The proposed physical-mechanical model of localized disturbances conformation cell membranes of higher plants. Conditions for the emergence of dissipative solitons microwave (UHF) and very high frequency (VVCH) ranges for existence hypersonic akustoelektromahnitnyh resonances cluster structures of cells of higher plants.*

***Physical and mechanical modeling of localized disturbances, conformation, membranes, cells, higher plants, cluster structure of plant cells.***

**Problem.** For the first study of the spatial structure of living matter cells using high electron microscopy showed that all cells of the inner space (nem'yazovah) really permeate the system thread and mikrotrubok. Mikronytky tube and keep all organelles of cells (in t. H. Higher plants) in certain places. They define the shape of the cell and its changes (conformation). The transfer of energy and information and all internal movements in the cell made using mikronytok and tubes. All these functions are carried out by the energy of ATP hydrolysis. The process of hydrolysis probably regulated by changing the concentration of doubly ionized calcium. The system mikronytok (microfilaments or microfibrils) and mikrotrubok in the cytoplasm plant was named cytoskeleton. Cytoplasmic membrane and all internal membranes of various cells (plants) in general terms have the same construction. They include fat-like molecules called lipids, proteins and carbohydrates in small quantities. Hydrocarbons (polysaccharides) usually form complexes with lipids (glycolipids) and proteins (glycoproteins).

According to modern ideas cell membranes - a liquid-mosaic patterns that keep locked in a double layer of lipid molecules oriented two-dimensional solutions in the transverse direction to the layers of protein molecules,



glycoproteins, glycolipids, and polysaccharides. The basis of this mosaic structure forms a double layer of lipid molecules with ionic and polar groups of atoms that lie on the outer and inner surfaces of the membrane in contact with water. The membranes with low protein latter as "icebergs" in the lipid layer. Due to the interaction between the protein molecules are usually collected in complexes that perform specific physiological functions.

The outer surface of living cells always positively charged, and the interior has a negative charge. Usually the potential value of the outer surface of the membrane is taken as zero. Then the inside negative potential. In normal condition zhyttyediyalnistnomu cell potential difference is nearly constant value (50 ... 80) mV. When the thickness of the membrane 5 to 6nm the electric field in the dielectric layer membrane is 105V / cm = 107 V / m.

Keeping potential difference and the difference of concentration of ions inside and outside of cells necessary for its normal functioning. To create an environment consumes 50% of the energy produced by the cell.

The passage of ions through the membrane cell plants due to two processes: passive and active transport. The first is the passage of neutral and charged chasynok through the membrane under the law of diffusion (Fick) with more places to places lower concentrations. This process is carried out under the concentration difference and the difference of electrical potential for charged particles. Joint action characterized by their electrochemical gradient.

The flow of particles in the passive transport towards smaller concentrations proportional difference in electrochemical potential. The coefficient of proportionality depends on the temperature and in some cases - of the difference of concentration and electrical potential. This dependence indicates that the process of passive transport - a non-linear effect. To create necessary for normal functioning of the living cell plants difference of electric potentials and ion concentrations inside and outside the cells required the forced displacement of the membrane with small areas in the field of higher concentrations, ie along a concentration gradient. These processes require energy consumption are called active transport.

Transport systems that are able to create the absorption energy corresponding to the potential difference and the concentration of ions, called ion pumps. There sodium-potassium pumps in the cytoplasmic membrane, providing them the necessary unequal distribution inside and outside the cells of plants. There are calcium pumps that create gradients of concentrations of calcium ions on the surfaces of the two membrane proton pumps, which form a concentration gradient of protons in the inner membrane of mitochondria.

Calcium pumps are part of a network of membrane tubes penetrating ksylemni floemni pathways and plants. Important issues to clarify the molecular mechanism of ion pumps is one of the unsolved in modern biophysics. It is not clear what forces cause the ions to move the electric field in the direction of higher concentrations.

It has been shown [1] that calcium pumps in the transport of molecules using the energy of ATP hydrolysis. It was found that when two transport of calcium consumed energy of hydrolysis of one molecule of ATP. Unfortunately not, no structure of protein-lipid complex that forms a calcium pump, or it works with the energy of hydrolysis of ATP is not yet understood.

**Analysis of publications on the subject of research.**In [1] are the main results of theoretical research on molecular vibration transfer excitations of electrons and protons in biological systems using personified hvyleutvoren (ie.. Solitons) and electromagnetic radiation (EMR) in living matter. Mechanism of energy transport in biological systems was devoted to a special meeting of the New York Academy of Sciences in 1973. However, participants did not come to a consensus and the question of "crisis" in bioenergy remained unresolved. In 1973 was published [3]. The researchers found that alpha-helical protein molecules can be distributed without energy loss and changing the shape of oscillating excitation of collective nature. Such excitation subsequently called Davydov solitons [4 9]. The paper [3], and the following are made in the ITF USSR Academy of Sciences [10, 11], initiated numerous research scientists (domestic and foreign) on the effectiveness of vibration energy transfer in biological systems solitons. Such research is largely decided on the crisis in bioenergy. It was also found that solitons can play an important role in many biological phenomena [12, 13].

Results and approaches cited above work used in this study.

**The purpose of research.** To prove a violation conformation localized cell membranes of higher plants within the proposed physical-mechanical model, which is based on the generation of cell clusters dissipative solitons UHF / UHF band and event hypersonic akustoelektromahnitnyh these resonances cluster structures in contact with each other along the perimeter of its surface membrane. To reduce the efficiency of energy transfer soliton excitation and lots of cell membranes with incorporated protein molecules in their natural oscillations (bending type) can be used EMR UHF / UHF-band low (non-thermal) intensity (with millimeter wavelength$\lambda = (5 \ldots 10) \cdot 10^{-3}$*m*).

**Results.** *Mitochondria and chloroplasts - the energy factories of plant cells.*All multicellular (eukaryotes) - green plants, fungi and protozoa - have cells that are in $10^3$ times the volume of bacteria cells. Energy demand of large masses of cytoplasm can be satisfied only by molecules *ATP*Which are synthesized in the cytoplasmic membrane.

Such cells except the kernel kept in a special inclusions (organelles) - thylakoids in chloroplasts of green algae and plants. The main purpose of these organelles - the supply of cell molecules of ATP. This kind of energy factories of cells.

Number of mitochondria in cells in some cases up to several tens of thousands. They have lateral dimensions $\sim(0{,}2 \ldots 5) \cdot 10^{-6} m$, Ellipsoidal or elongated rod-shaped form. Mitochondria in the cell can move and usually focus on those that place, where the most intensive use of energy.

Each mitochondrion is surrounded by two membranes. The structure of foreign fairly smooth coincides with the external structure of the cytoplasmic membrane of the cell. It keeps the protein complexes that form channels that let the neutral molecules with low weight.

The inner membrane, often called the conjugate, is a closed sac with numerous folds called cristae. Thanks to Christy significantly increases the surface of the inner membrane, which is the main body that synthesizes molecules *ATP*. The density of protein complexes in the membranes of conjugated significantly higher (70%) than in the cytoplasm.

In the cells of green algae and higher plants phosphorylation occurs in organelles - chloroplasts, which are painted in green. Each cell holds one of (Chlorella) to hundreds of chloroplasts. Chloroplasts significantly larger than mitochondria. They have a diameter of 4 to 10 microns$(4 \ldots 10) \cdot 10^{-6}$ and thickness (1 ... 2) *um* = M.$(1 \ldots 2) \cdot 10^{-6}$

Chloroplasts kept in the shell, which is created from two closely placed membranes. Inside the second shell is a colorless liquid - stroma, in which submerged edges, which is chlorophyll. Faces, in turn, consist of thin plates stoyok, thylakoids, which overlap each other.

Thylakoids membranes surrounded and held its chlorophyll molecule. On the surface of thylakoids is mushroom grow, turned toward the stroma. The inner region thylakoids charged positively stroma has a negative charge in the space between the outer membrane of chloroplast positive electric charge.

In the cells of green rosyn there photosynthetic chloroplasts and mitochondria. In the dark cells breathe oxygen and glucose is oxidized in the mitochondria in the synthesis of ATP. In light of the work chloroplasts.

Thus, in the synthesis of ATP may participate cytoplasmic membrane prokaryotic cells of bacteria and blue-green algae, internal membranes of mitochondria and chloroplasts membranes thylakoids green plants despite the different physical nature of energy used (oxidation, light absorption), the mechanism of ATP synthesis and ion transport through these membranes is almost the same.

ATP synthesis is partially in the cytoplasm, but the basic processes occurring phosphorylation in membranes. The mechanism of phosphorylation bound (conjugate) to the process of extracting energy by oxidation of organic compounds (breathing) and the absorption of light. Therefore thylakoids membranes, internal membranes of mitochondria and cytoplasmic membrane of bacteria called spryahayuchymy membranes.

Enerhetyzovanyy state membrane synthesis in addition to ATP necessary for many processes in the cell. In particular, the state used sodium pump membrane, moving sodium ions in exchange for protons moving towards smaller concentrations membrane electric field facilitates the movement of protons and prevents movement of sodium ions. Equilibrium occurs when the difference in the concentrations of sodium ions aligned with the difference of the concentration of protons, which is supported by external sources - respiration or photosynthesis.

The difference proton concentration on two sides of the membrane ensures the transfer of ADP and phosphate molecules in the matrix of mitochondria and extraction of ATP. Phosphate is the mitochondria in the cytoplasm in the form of negatively charged ion. It moves to the matrix under an electric field spryahayuchoyi membrane. The molecules of ADP and ATP in the cell are in a state of ions: ADF3- and ADF4-. Therefore, the transition matrix ADF3- inside and passing ADF4- equivalent displacement of the membrane matrix with a negative charge or navigate within a matrix of positive charge.

As mentioned above, the cell cytoplasm and mitochondrial matrix with negative potential. In spryahayuchoyi membrane surrounding matrix, each mitochondrion is the outer membrane. On the one hand, it allows you to have the outer surface of the membrane spryahayuchoyi positive potential, and the second - in the small space between the membranes more easily create large concentration of protons required for conversion spryahayuchoyi membrane in enerhetyzovanyy state. This small space is also easy to create the necessary concentration of ADP and phosphate molecules required for the synthesis of ATP.

Mitochondria are almost indistinguishable from bacteria in size. The composition of lipids in membranes of bacteria and internal (spryahayuchyh) membranes of mitochondria is almost the same. Mitochondria have an autonomous mechanism of protein synthesis and nucleic acids, which allows them to synthesize their own molecules. It appears that mitochondrial DNA is a circular building as the DNA of bacteria.

ATP, based on the mitochondria to the outside of the mitochondrial membrane, is involved in the synthesis of molecules of creatine creatine molecule. ADP molecule, which then formed again falls into the mitochondria, coming second in the synthesis of ATP. Creatine molecules diffuse in space consumption. Here creatine phosphate group from a molecule moves to ADP, which is converted to ATP. Then formed ATP molecules provide energy directly relevant processes. After cleavage fosfidnoyi group of creatine creatine returned to the mitochondria, and the cycle repeats again.

Thus, the living cell has two types of energy for various biological processes in different environments. One chemical energy that is stored in the synthesis of ATP. It is used in the aquatic environment (cytoplasm), in which these molecules dissolve easily. They did not dissolve in the lipid layer of the cell membrane, so for energy processes occurring inside the membranes used proton membrane potential enerhetyzovanoho state. It is rather important and it is essential that energy proton gradient can be used for the synthesis of ATP in ATP synthesis enzymes. Conversely, the energy of ATP hydrolysis can be used to create a proton gradient.

*Soliton excitons and polaritons in Quasi-Onedimensional clusters plant cells.*It is known [1] that solitons can be excited in Quasi-Onedimensional nonlinear systems with dispersion.

The idea, the physical mechanisms and their justification presented in [1, 11, 13] used in this study.

In plant cell clusters (each cluster of about 100 cells) were placed in ksylemnyh floemnyh and pathways, and contact each other along surfaces with fractal dimension (due to constant fluctuations bending type of cell membranes surface layers of the cluster) may excited influenced by external disturbance (EMR UHF / UHF band) oscillations in the resonance region akustoelektromahnitnoho type.

In these cells cluster with a distinctive type of structural elements (eg, chloroplasts / mitochondria, thylakoids) operating frequency EMR $\Omega_{\text{EMB}}$ with wave vector, which excites (resonance) acoustic oscillations () type (in the hypersonic range) - ie.. Optical fraktony (also with). The table shows the values, and in which there akustoelektromahnitnyy response in cell clusters (plants) for each (ie). $k \to 0 \Omega_{AK} k \to 0 \lambda_{\text{EMB}} \lambda_{\text{AK}} \Omega_{\text{EMB}} \Omega_{AK} = \Omega_{\text{EMB}}$

***1. Value*** *$\lambda_{\text{EMB}}$, M; City for resonance type: $\lambda_{\text{AK}} \Omega_{\text{EMB}} = \Omega_{AK}$.*

| $\Omega_{\text{EMB}}$, GHz | $\lambda_{\text{EMB}}$*City* | $\lambda_{\text{AK}}$*City* |
|---|---|---|
| 5 | $6 \cdot 10^{-2}$ | $2 \cdot 10^{-7}$ |
| 10 | $3 \cdot 10^{-2}$ | $1 \cdot 10^{-7}$ |
| 15 | $2 \cdot 10^{-2}$ | $6{,}67 \cdot 10^{-8}$ |
| 20 | $1{,}5 \cdot 10^{-2}$ | $5 \cdot 10^{-8}$ |

| | | |
|---|---|---|
| 25 | $1{,}2 \cdot 10^{-2}$ | $4 \cdot 10^{-8}$ |
| 30 | $1 \cdot 10^{-2}$ | $3{,}33 \cdot 10^{-8}$ |
| 35 | $8{,}57 \cdot 10^{-3}$ | $2{,}86 \cdot 10^{-8}$ |
| 40 | $7{,}5 \cdot 10^{-3}$ | $2{,}5 \cdot 10^{-8}$ |
| 45 | $6{,}67 \cdot 10^{-3}$ | $2{,}22 \cdot 10^{-8}$ |
| 50 | $6 \cdot 10^{-3}$ | $2 \cdot 10^{-8}$ |
| 55 | $5{,}45 \cdot 10^{-3}$ | $1{,}82 \cdot 10^{-8}$ |
| 60 | $5 \cdot 10^{-3}$ | $1{,}67 \cdot 10^{-8}$ |

The table shows EMR UHF / UHF-band (with $\Omega_{\text{EMB}} = (5 \ldots 60)$ GHz) Is in cell clusters (in their structural elements) acoustic vibrations hypersonic range (called fraktony) of nanometers. These variations can be distributed along the same structural elements of cell clusters (chloroplasts, mitochondria, thylakoids) and transferred from one cluster to another, changing the distance in space mizhschilynnomu contacting (through the membrane surface) cells (cells and clusters), and at the same time changing fractal dimension of the surface of a single (excited EMR) cells (and the cluster as a whole). Changing the fractal dimension of contacting neighboring cells resulting from changes in the fractal dimension of structural elements (organelles) cells (mitochondria, thylakoids, chloroplasts) and total cell cluster as a whole. Thus information from the excited cells (cluster of cells) passed on along the floemnoho (ksylemnoho) leading the way. Thus, the form (material) excitation signal of a particular area floemnoho leading the way (as well as ksylemnoho) - a modified fractal dimension () of this section (first individual organelles, then a single cell, then a cluster of plant cells.) This physical mechanism for We believe that underlying signaling pathways in plants when they are excited by an external stimulus specific frequency (). Carriers such information are protein molecules within the membrane structural elements of cells (mitochondria / chloroplasts) at a higher hierarchical level - the cell membrane (some), but at a higher hierarchical level - clusters of plant cells, concentrated in floemnyh / ksylemnyh top tract (Fig. 1)$\lambda_{\text{АК}} = (16{,}7 \ldots 200)\text{D}_f\Omega_{\text{EMB}}$

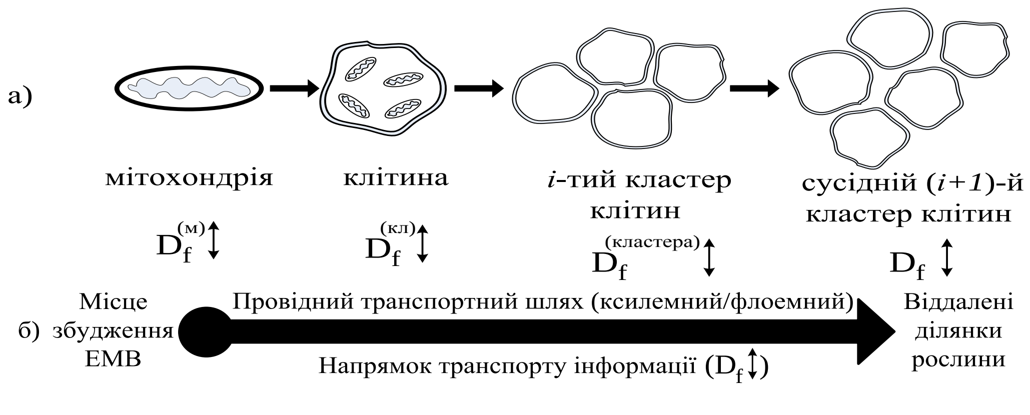


Fig. 1. The physical mechanism of information transfer excitation EMR structural elements (mitochondria / chloroplast) single cell plants in

its major transport routes (ksylemnyh / floemnyh): a - structural and hierarchical levels of information; b - the direction of change in information transfer.$D_f$

It should be noted that for effective communication of change $D_f$ along the transport pathways of plants can use two types of excitations in clusters of cells: longitudinal (ie.. fraktony acoustic) and bending (optical fraktony) are shown in Fig. 2.

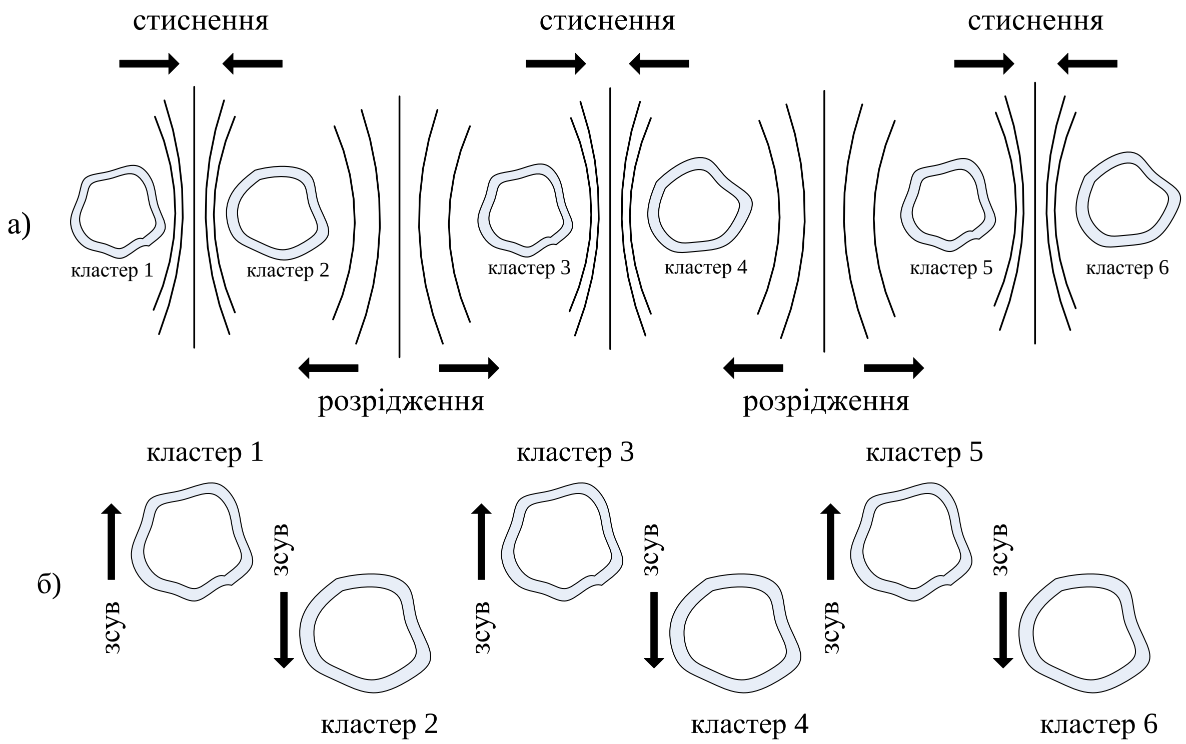


Fig. 2. Types fraktoniv that can be distributed in clusters of cells in plants leading transportation routes: a - Acoustic fraktony; B - Optical fraktony.

Regarding changes $D_f$ following should be noted: it is well known that the fractal / fractal structure has the property of self-similarity, fractional (or part of the whole and fractional) dimension (different from 1 - to line 2 - for plane 3 - for volume) is determined, for example, by counting squares as follows:

$$D_f = \lim_{L\to\infty} \frac{\ln\{N(L)\}}{\ln L} \qquad (1)$$

where $N(L)$ - The number of squares with a side of which is necessary to cover this fractal structure (cell membrane, the membrane of mitochondria, chloroplast membrane, the membrane surface layer cluster plant cells.) It is clear that $LD_f$ in titles structural element lies within:

$$1 < D_f < 2 \qquad (2)$$

In addition, the border of the fractal structure of undifferentiated (in the mathematical sense), ie, the shape of the curve that limits the surface fractal structures can not find the original in any point of the surface (!). Fractal dimension () is a measure space filling fractal structure. When, for example, the cell (and its outer membrane) is in some plants (nezbudzhenomu EMR) state, takes some intermediate value () on the interval [1; 2], that is. If there is excitement outside of the cell (its organelles) increases by a certain value () to. When a cell loses its excitation energy from the outside (through EMR), then it comes (to). The value determines the number of factors (type of cell plant species, especially the construction of organelles, types of organelles that are present in the plant). In addition, we believe that other things being equal (temperature, pressure, light, etc.). (Resonant frequency, which sets the rhythm of normal operation) plants (day and night) and its development) can be defined frequency CMB universe that is in the range of 60 GHz (with an average temperature of the universe, the frequency GHz corresponds to maximum energy characteristics of electromagnetic radiation - radiation power spectral integrity).$\mathrm{D}_f \mathrm{D}_f \mathrm{D}_{f_0} \mathrm{D}_{f_0} \in [1;\ 2] \mathrm{D}_f \mathrm{D}_{f_0} \mathrm{D}_{f_{max}} \to 2 \mathrm{D}_f \mathrm{D}_{f_{max}} \mathrm{D}_{f_0} \mathrm{D}_{f_0} \Omega_{\text{EMB}} T = 2{,}7°K \Omega_{\text{EMB}} = 60\ \mathrm{P}_s, \frac{\text{Вт}}{\text{Гц·м}^2}$

Fractal structures inherent property (scale invariance), ie uniformity over a wide range of scales. As a result, any small chasyna fractal holds the information about all the fractal (eg plant cell organelles and whole cells cluster of plants). Self similarity of fractal structures is the result of iteration functions with feedback (ie.. The same reference feedback), or in other words, is defined, built and develops in space and time for recursive (feedback) algorithm. Complex forms fractal structures are created using special "genetic" rules and material basis of their existence (the carrier of information about them) is, in our opinion, morphogenetic field of fractal structures that have akustoelektromahnitnu nature (the EMR is in the microwave / UHF range, and acoustic fields supported fractal structures - in the hypersonic range corresponding to the scale nanostructured organelles of plant cells, the cell membrane with protein molecules, "embedded" in their semi channels). This is the physical mechanism of excitation transfer information "fragments" plant cells (as well as the cell and its membrane, clusters of similar cells) specifies neighbor (local) (in the sense - size) and distant (global) order (defines the essence of functioning in plants transport pathways). By the way, all of the above, lets briefly mathematically describe themselves (fractal) structure and processes occurring in them. It is clear that in heterogeneous structures, such floemnyh / ksylemnyh major transport routes, depending on the - values can be excited vibration-wave resonances (hvyleutvorennya), similar to phonons in solids, which are distributed along these structures are called Thrace tones.$\mathrm{D}_f \mathrm{D}_f$

Excitation of the main resonance () fluctuations in organelles (cell membrane, the surface layer of the membrane cell plants cluster) leads to two additional interactions. The first of them - a resonant interaction (such as dipole - dipole interaction) that occurs between clusters of cells (cell organelles between first, then between individual cells cluster in their interaction along the contact surface (its membranes)). This interaction is jumping fluctuations (fraktoniv) from one cluster to another cell (neighboring) cluster (like a pendulum oscillation transmission to others the same for their weak coupling). It is clear that such interaction clusters of cells depends on the distance between clusters.$\Omega_{\mathrm{EMB}} = \Omega_{AK}$

Another interaction is deformation. Excitation main resonance () in this cluster changed its interaction (and, of course) with neighboring clusters, which causes a change in the mutual distance between clusters - moving them (center of gravity) of the initial equilibrium positions.$\Omega_{\mathrm{EMB}} = \Omega_{AK} \mathrm{D}_f$

Thus, the deformation is determined by the interaction of the primary bond resonance (vibrations) () offset equilibrium positions of clusters of cells.$\Omega_{\mathrm{EMB}} = \Omega_{AK}$

In our opinion, the first type of interaction leads to cluster structures in optical fraktoniv, and the second - acoustic fraktoniv. This should be carried out wave frequency synchronization (or conditions) imposed on the frequency of excitation, optical and acoustic fraktoniv and their wave vectors () type:$\vec{k}$

$$\begin{cases} \Omega_{\mathrm{EMB}} = \Omega_{AK} = \Omega_{of} + \Omega_{af} \\ \vec{k}_{\mathrm{EMB}} = \vec{k}_{AK} = \vec{k}_{of} + \vec{k}_{af} \end{cases} \quad (3)$$

The expressions in (3) have the following physical meaning: $\Omega_{\mathrm{EMB}}$,$\Omega_{AK}$ - Frequency resonance akustoelektromahnitnoho (- frequency "pump"); - Frequency optical fraktonu; frequency acoustic fraktonu; - Wave vector EMR "pump" and the acoustic field (hypersonic range), respectively. Note that the dimension $\Omega_{\mathrm{EMB}} = \Omega_{AK} = \Omega_{pump} \Omega_{of} \Omega_{af} \vec{k}_{\mathrm{EMB}} \equiv \vec{k}_{pump} = \vec{k}_{AK} [\Omega] = c^{-1}$ =*Hz*And $[\vec{k}]$ =*m-1*. Given the existing fractal structures in relation to frequency (3) appears exponent (for each) in the form. With respect to the wave vector (3) it should be noted that:$\mathrm{D}_f \vec{k}$

$$|\vec{k}| = \sqrt{(k_x)^2 + (k_y)^2 + (k_z)^2} \quad (4)$$

For ordinary metric spaces in fractal structures will look like:

$$|\vec{k}|^{\mathrm{D}_f} = \sqrt{(k_x)^{2\mathrm{D}_f} + (k_y)^{2\mathrm{D}_f} + (k_z)^{2\mathrm{D}_f}} \quad (5)$$

Fig. Figure 3 () shows the frequency of the wave conditions in synchronism interpretation (3)$\omega, \vec{k}$

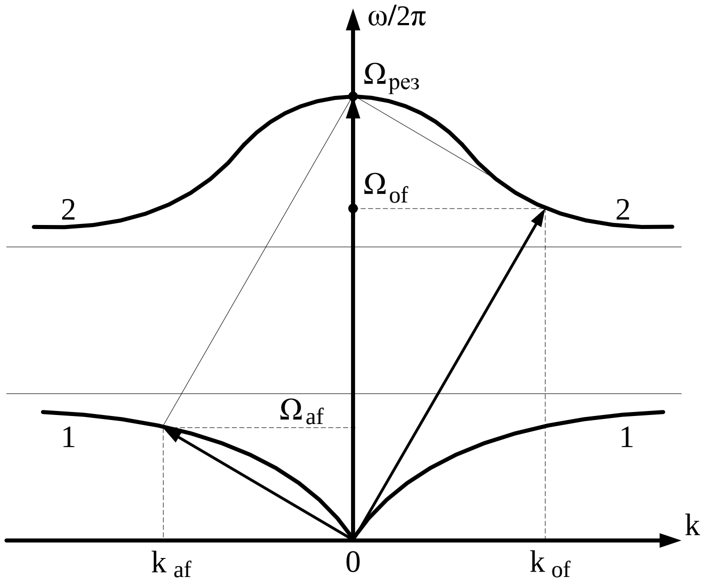


Fig. 3. Frequency-wave synchronization in cellular structures of plants.

Nonlinear processes that comply with matching type (3), there are cellular structures in higher plants through point (irregular) contacts the membrane surfaces ohreby cluster of cells in contact with each other and with similar surfaces adjacent to the present clusters of cells, and the resulting dispersion wave formations committed to linked into the spatial spreading of localized excitation composed of many monochromatic waves. C nonlinear wave formations (such as solitons) is intensive interaction of monochromatic components of the package. This interaction leads to a redistribution of power between them. If this redistribution is to ensure that the energy shown by fast waves wave packet and transmitted waves that are lagging behind, then the result is a stable excitation distributed as a whole. It is a great stability of solitons (acoustic and optical) stimulates numerous attempts to use the study of nonlinear wave structures in various (including biological) environments.

We believe that the formation of wave-type optical fraktonu (on the optical branch) and acoustic fraktonu (acoustic branch) (Fig. 3) is a soliton.

The rate of transfer of energy (ie.. The group velocity of waves) in optical fraktoniv negative, and the acoustic fraktoniv - positive:$\upsilon_g$

$$\upsilon_{g_{of}} = \frac{d\Omega}{dk} < 0, \;\; \upsilon_{g_{af}} = \frac{d\Omega}{dk} > 0 \qquad (6)$$

In quantum transitions in excited state under the influence of electromagnetic radiation (light of a certain frequency) rather heavy cellular structures (clusters of cells) do not have time to shift to their equilibrium positions (Frank-Condon principle). In this case, the collective excited state takes the main part only additional interaction of the first type - resonance. These excited states are characterized by a uniform distribution of the probability of excitation of organelles, in all some individual plant cells and their clusters. This is not disturbed periodic distribution of cells along a particular cluster or clusters of cells along the path leading vehicle plants (floemnoho / ksylemnoho). Elementary excitations of this type is characterized by monochromatic waves, which have a fixed energy (frequency), the phase velocity () and wavelength. They have a name (for acoustic branches) exciton polaritons or - single opto-mechanical fluctuations (optical branches). $\Omega_{\text{EMB}}\upsilon_{\Phi} = \frac{\Omega}{k}\lambda$

Moving the wave packet (or exciton polaritons movement) is not accompanied by critical deformation circuit cells (cells or clusters) plants. Excitons / polaritons only tolerate vibration resonance excitation energy () with a relatively small group velocity (Fig. 4).$\Omega_p = \Omega_{\text{EMB}} = \Omega_{AK}$

However, it should be borne in mind that the exciton energy transfer / polariton wave packet is relatively low efficiency for two reasons: 1) the area that is covered by the excitement, you move increases as the wave packet moving components with different phase () speeds; 2) wave packets in motion slowed, giving energy of thermal fluctuations (molecules, atoms) environment (higher plant cells). The process of energy dissipation due to deformation interaction with displacements equilibrium positions of individual cells (their organelles) and clusters of plant cells.$\upsilon_{\Phi} = \frac{\Omega}{k}$

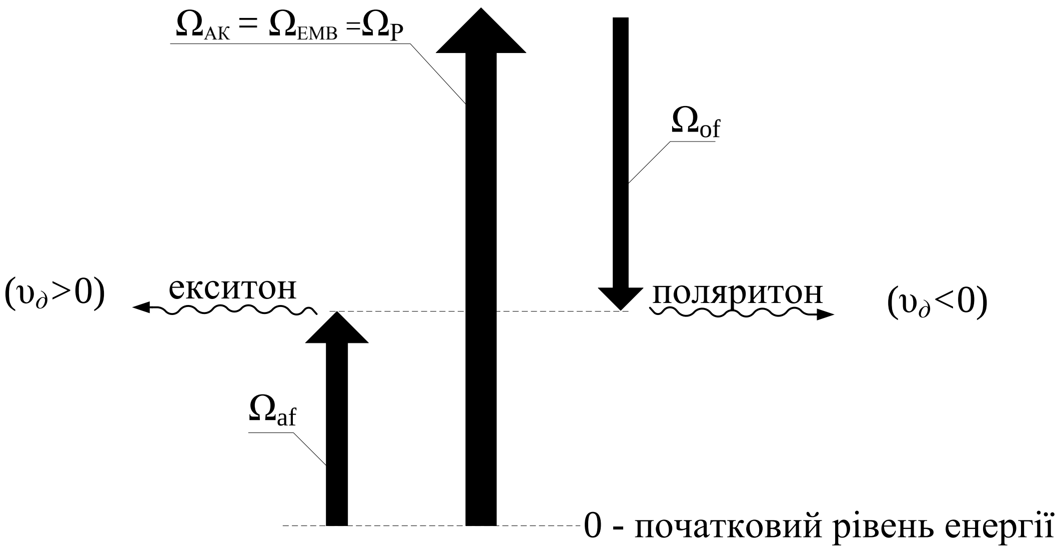


Fig. 4. exciton-polariton emergence of steam in the presence of cells / clusters of cells of higher plants akustoelektromahnitnoho resonance.

Compared with excitons / polariton solitons (acoustic and optical branches) are moving at a rate less than the longitudinal speed of sound, with less overall energy (when bound resonance vibrations of deformation - optical and acoustic fraktony energy is released and there is such a connection thus winning for energy), topologically stable. Therefore, their kinetic energy is not converted into energy of thermal motion, and solitons are generated only at the ends of the pathways (transport) of higher plants or parts of protein molecules found in cell membranes or cell clusters at the ends of structures (first and last cell clusters located in particular the transport pathways of higher plants). Therefore, "destroy" soliton (due to its topological stability) is much more difficult than usual exciton / polariton. $\Omega_p = \Omega_{\mathrm{EMB}} = \Omega_{AK}$

The formation of soliton associated with displacement of equilibrium positions organelles, single cells, clusters of cells of plants, so the light (EMR) does not generate solitons. For this reason, there is very little chance of light emission of solitons. (Another thing - the acoustic field hypersonic range.)

In addition, [10 13], solitons can be excited by local external influences, such as chemical reactions in plants (in their organelles, cells, clusters of cells located in a specific key transport routes). Most likely their excitement when local impact / effect of externally implemented at the end of the molecular chain (protein molecules) on the membrane organelles in the cell surface membrane / cell clusters located at one end of the transport path of higher plants.

In higher plants and ksylemni floemni major transport routes interact. Therefore, the full theoretical description of excited states of cell organelles, cell clusters should consider the resonant interaction between clusters of cells that make up the different transport routes plant.

Note that the account of this fact can lead [10 13] to the emergence of such structures in the three types of stationary solitons, which correspond to the same resonant / main fluctuations ():$\Omega_{\mathrm{EMB}} = \Omega_{AK} = \Omega_{pump}$

1) symmetric solitons (along each transport path plant propagating disturbance in phase (with the same phase);

2) asymmetrical solitons (disturbance along transport routes with some plants moving phase shift and excitation occurs in the area of local bending of each type of interacting paths).

If interacting transport routes plant transient excited state must superposition of symmetric and asymmetric soliton, then there are beats that match the excitement jump from one vehicle to the next path.

This jump is caused by the resonant interaction between the cluster structure (between individual cells) transport routes neighboring plants.

The period of such movements (perestrybuvan) lies in the range.$T = (2 \dots 3) \cdot 10^{-12} c = (2 \dots 3)$ нс

## Conclusions

1. The proposed physical-mechanical model of local disturbances conformation cell membranes of higher plants, which allows to determine the physical causes and conditions of dissipative solitons microwave / VVCH-band electromagnetic waves and resonances in hypersonic akustoelektromahnitnyh cluster of cell structures.

2. Cluster cellular structures placed on transport routes leading higher plants (ksylemnyy and floemnyy) have fractal properties and their inherent only to them fractal dimension formula (eg, surface membrane organelles, individual cells in contact with one another cluster of cells by surface contact mizhschilynni ) that changes in processes, these structures external excitation EMR that causes them resonances akustoelektromahnitnoyi nature. It resonances lie in the range hypersonic acoustic oscillations of such structures.

3. The change in the excited cell cellular structures transferred quickly to remote areas of transport routes plants from places excitation of the structure using solitons (acoustic and optical branches), which are also there (symmetric / asymmetric) and the interaction of neighboring transport routes (ksylemnoho floemnoho and interacting with each other).$D_f$

## References

1. .
2. .
3. . /
*A.S.* -1973. - Vol.
4. / , //. - Vol..
5. / // . - Vol.
6. . -
Vol.
7. *Scott A. C.* The Vibrational Structure of Davydov Solitons. / A. C. Scott // Physica Scripta.- 1982. Vol. 25 - R. 651 - 658.
8. *Scott A. C.* Solitons on the Alpha-Helix proteins / AC Scott // Struct. and Dynam. Nucl. Acids and Proteins. - 1983. -№ 4. - R. 389-404.
9. *Eilbeck J.C.* Davydov Soliton on the Alpha-Helix. A 16 mm mute film. 1 Wood road. / J.C.Eilbeck. - Wimbledon; London, S.W. 200HM. - 1979.
10. *AS Davydov*. Biology and Quantum Mechanics. / AS Davydov. - Kiev: Naukova Dumka, 1979. - 296 p.
11. *Davydov A.*Molekulyarnын solitons in systems / AS Davydov - Kiev: Naukova Dumka, 1984. - 288 p.
12. *Davydov A. S.* Biology and Quantum Mechanics. / A. S. Davydov. - Oxford: Pergamon Press, 1981. - 225 p.

13. *Davydov A. S.* Solitons in Molecular Systems. / A. S. Davydov. - Dordrecht: Reidel, 1985. - 319 p.

*Proposals physicochemical mehanycheskaya model lokalyzovannыh violations conformation of membrane cell plants High society. Ustanovlenы occurrence dissipative terms solytonov sverhvыsokochastotnoho (SHF) and krajne vыsokochastotnoho (EHF) dyapazonov existence at hypersonic akustoэlektro-mahnytnыh resonances klasternыh High society structures cell plants.*

***Physical and mehanycheskoe Modeling, lokalyzovannыe violations, conformation, and membranes, cells, plants vыsshye, dissipative solitons, sverhvыsoko-chastotnыy (SHF) and krajne vыsokochastotnыy (EHF) dyapazonы, hyperzvukovыe acousto-electromagnetic rezonansы, klasternыe cell structure of plants.***

*The paper has proposed a physical-mechanical model of localized disturbances of conformation of the cell membranes in high plants, as well as the conditions for the formation of dissipative solitons, ultra-high frequency (UHF) and extremely high frequency (EHF) range with the existence of hypersonic acoustic and electromagnetic resonances cluster structures of the cells of higher plants.*

***Physico-mechanical modeling, localized disorders, conformation, membrane, cells, high plants, dissipative solitons, ultra high frequency (UHF) range, extremely high frequency (EHF) range, hypersonic acoustic and electromagnetic resonances, cluster structures of plant cells.***

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## IMPROVING ENERGY MOVEMENT MODE Swing mechanism boom cranes VIBRATIONS IN VIEW OF CARGO

***VS Loveykin, PhD***
***VV Melnichenko, a graduate student ****

*In the article the way the fluctuations of cargo during the rotation mechanism jib cranes. Optimization mode starting mechanism for turning the tap is performed using methods of variations. This paper uses an integrated complex criterion as a linear convolution of two individual criteria, reflecting the effect of energy loss and dynamic loads.*

* Supervisor - PhD VS Loveykin