



The Problem of Electromagnetic Pollution of the Environment

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Owing to the onrush of technical progress observed, in particular during the last century, the problem of this process results' effect on vital functions of a human organism has attracted more and more attention. In particular, this concerns the effect of electromagnetic fields of various bands. Since the moment they invented radio, our planet's radiation has grown by several times within the radio-frequency region of electromagnetic waves and now from the point of view of an outsider we look like a star with an increasing radiant power. Due to objective reasons a human organism is not able to adjust to technogenic electromagnetic radiation and, in some sense, does not have appropriate adjustment mechanisms. This problem has already been named electromagnetic smog. Widely spread personal cellular communication obviously makes this problem particularly acute.

The fact that cellular phones are in direct contact with a human organism both when transmitting and receiving a desired signal and in sleep mode constitutes their peculiarity as electromagnetic radiation generators. And this contact is rather deep since it is effected by cerebral cells, which are correspondingly influenced first of all. Nowadays the issue, concerning the influence of cellular phones radiation in particular and industrial radiation in general on the whole human organism as a biological hypercomplex system is of extreme current interest and has a marked business targeting. If a device launched on the market generates electromagnetic oscillations, which are harmful for a human organism it evidently should be prohibited and a manufacturer naturally will bear considerable financial losses. The problem is to define adequately the level of harmfulness of particular radiation for a bioform; this factor is composed of several constituent elements. Among them frequency, peak and phase elements may be distinguished.

The frequency issue involves analysis of harmfulness (or usefulness) level of a particular electromagnetic radiation spectrum. The core of the issue is that any bioorganism is not shaped in complete isolation from the outworld but alternatively within full and tough contact. During millions of years of its existence organic life of our planet has been developing under the influence of natural electromagnetic fields and has not only adapted for them very well but also can't exist without their influence. That is why the isolation of a living organism from this irradiation, which is an integral part of their habitat, will make only harm. The main point is, which types of radiation are useful for a human being and which are alternatively harmful ones. For instance, according to everyone's opinion, solar radiation is quite useful except for the periods of active Sun and the areas where ozone holes exist in the atmosphere. And what to do with artificial radiation of UV lamps in sun rooms, which generate quite another radiation spectrum with a strong UV component. They have not been tested as to negative effects with a practical purpose – it is enough that they create good tan and what consequences they may cause does not bother sellers of these services very much. An organism (not one but at least organisms of a test group of various ages, different types of skin and etc.) is required to be examined before artificial tanning, during and after it. It is obvious that such examination is not real, the more so because it is absolutely unnecessary for beauty parlors' owners but it may appear extremely harmful for them. The similar situation is observed when using any device, generating electromagnetic oscillations of a particular spectrum.

The amplitude issue means the problem of radiation intensity influencing the degree of its effect. Nanotechnologies development and control and metrological equipment improvement has raised absolutely unexpected facts, which required significant investigators' efforts to explain them. Mild and ultramild effects of electromagnetic, electric and magnetic fields appear to influence early known physical phenomena such as crystallization, polymerization, change of state and etc. At this, the effects' intensity may be considerably lower than the level of thermal vibrations in a solid body



structure, i.e. according to traditional views such effect should be immediately diffused and dissolved. Since most biological systems constitute colloid systems they are subject to fixed investigation with regard to nanotechnologies.

Phenomenon of mild and ultra mild effect on biological and physical systems

In the course of multiple studies the most interesting facts, regarding mild and ultra mild exposure of various nature on different physical and biological objects and processes, have been established. In spite of the fact that intensity of such influence is extremely low such impacts are unambiguously recorded with regard to various types of exposure and multiple physical systems. This problem was named “KT problem” since in many cases power or intensity of exposure on a system is obviously lower (sometimes by an order) than phonon energy – atoms’ thermal vibrations defined as Boltzmann constant multiplied on T system’s average temperature. At first sight such exposure, which is lower than the thermal noise level, cannot have any influence on the system. Test data, however, prove otherwise.

In [1,2] when studying the influence of pulsed magnetic fields (PMF) on condensed media it was found that a short-term exposure of mild PMF causes a long-term change in the structure and physical properties of a wide class of nonmagnetic substances. At this, after the exposure is completed a delay in showing the effects and long-term non-monotone kinetics nature of these processes are observed. In [3] it is shown that under the exposure of a very mild PMF with the peak of about 0,015 Tl per a model polymer, a melting temperature, activation energy and crystallization temperature change not immediately but within 25 hours after the exposure has been stopped and stay unchanged within 1500 hours!

Similar results were achieved with regard to the exposure of mild PMF (0,4 Tl) on parallel-sided plates of single-crystalline silicon [4]. Short-term exposure of PMF is determined to cause long-term non-monotone changes in the surface topology this time. The recorded changes reach its maximum within about 150 – 200 hours after the exposure has been stopped. Similar effects are observed in high-temperature superconductors [5] and zirconium boride films applied on a steel substrate [6]. These facts have no clear-cut explanation yet and though we obviously deal with one and the same physical mechanism, more or less comprehensive and reasonable explanation is usually found for each particular case.

The like phenomena have also been observed in biological systems. In magnetobiological review [7] it is noted that though magnetobiology has been developing for about 20 years it doesn’t yet have any theory and general physical concepts and even any forecast theoretical models. Magnetobiology studies mainly biological responses and mechanism of effect of very mild (less than 1 mTl) magnetic fields. Biological systems of effect of such fields is supposed to be beyond the threshold of protective biological mechanisms engaging and able to be accumulated on the sub-cellular level, i.e. the level of genetic processes. At this, there are assumptions that the effect mild physical and chemical factors on biological systems has informative nature, believing that such systems are far from balance and rather mild exposure is enough to make the system pass the bifurcation point, implementing biological amplification of a weak magnetic field signal. The question why thermal fluctuations, which are ten-order exceeding an energy quantum of electromagnetic field, do not destruct magnetobiological effect, is associated with the concept of coherent exposure of the external factor against the background of non-coherent thermal noise. Then due to spatial coherence the system of oscillators may be build-up and a quantum of collective excitation energy may be released, though there are different points of view on this issue [8].

In various physical and biological structures like in elastic medium, body waves and surface waves in particular may appear. Surface waves capability to localize energy of perturbations formed in a narrow surface layer causes marked phenomena, which accompany the perturbation sources movement along the surface. At this, in the elastic medium resonance effects also become apparent when free surfaces appear and [9] have mostly fractal nature. It is natural to assume that most of the



observed effects of mild and ultramild perturbations exposure on physical and biological systems are related to resonance processes.

Due to lack of common view on the mechanisms of external field energy absorption by colloid systems and in particular due to KT problem, in work [10] it is suggested that dissipative resonance concept should be introduced. The meaning of this phenomenon is that external field energy can convert into energy of mechanical oscillations of viscoelastic distributed medium, containing particles – electromagnetic radiation acceptors. Interactivity between the external field and viscoelastic colloid medium may result in forming in the system of an order structure, which is compared to the phased lattice in some aspects. At this, separate oscillations of particles under the external field influence are cophasal thus causing an increase in energy of the oscillatory process, which exists in the medium up to figures, exceeding thermal noise threshold (KT) [11]. The authors of this idea have introduced and given prove to the concept of dissipative resonance and concluded that in this case a new very important class of physical phenomena exist. This may not only explain the nature of joint exposure of mild electromagnetic fields on various physical and chemical systems, including biological ones, but also is very significant in the structural organization of these objects. Dissipative resonance phenomenon bears certain similarities to stochastic resonance [12-14], studied below. In addition to these works we introduce a new concept of an acceptor, including not only thermal noise but also informative component of an energy quantum, which is particularly important.

In general, the dissipative resonance represents a phenomenon of increasing oscillations under the influence of external periodical forces due to the formation of an order structure in the system. It is a particular case of more general class of self-organization processes in dissipative structures, the distinctive feature of which is quasi-periodic nature of changes in certain system parameters. The dissipative resonance is a fundamentally new class of physical phenomena of resonance type [15]. One of its properties is the lack of some separated resonance frequency since the system is capable to tune to any random external frequency. At this, time of oscillations increase is defined not by the time of oscillations formation but exactly by the time of the system adjustment (time of the order structure appearance). However the dissipative resonance phenomenon represents only one possible cooperative mechanisms of low-intensity electromagnetic fields exposure on biological and physico-chemical systems [15].

The stochastic resonance phenomenon was found about twenty years ago and was named as stochastic filtration. Presence of noise sources in nonlinear dynamic systems was ascertained to be able to induce fundamentally new operational modes, which can't be implemented if there are no noises [14]. Noise in such systems appeared to play the constructive role, stimulating the growth in the order level. The stochastic resonance effect defines a group of phenomena, in which the response of a nonlinear system for a weak external signal is significantly strengthened with the noise intensity growth in the system. The stochastic resonance effect represents a fundamental general physical phenomenon with inherent general fundamental properties apparent in an increased output signal order level under optimal noise level [12].

There is every reason to believe that in the course of vital functions implementation living organisms have adapted for using unavoidable internal noise and environment noise for optimal picking out useful information, i.e. that component, which we mentioned above.

When stochastic systems are exposed to a periodic signal, stochastic synchronization is observed, i.e. the system may catch an external signal frequency and it becomes possible to control the system parameters, which is in stochastic nonlinear dynamics state. Synchronization of a stochastic resonators set by a weak external periodic signal may also take place. This case is especially important for studying biological systems. This new circumstance is related to the fact that internal noise of a biological system acts as a noise oscillation required for the stochastic resonance to be implemented [14].

In work [16], which represents a review of nanotribology issues, it is noted that when using a atomic-power microscope to study tribological issues at the nanolevel, the image obtained has a



frequency, which corresponds to that of a constant of the studied material lattice, though the contact area usually includes a considerably amount of atoms (from 10 to 10000). At this, physics of this effect is not understood, since it is not clear in general how such large group of atoms transfers to interatomic space as the authors of this work admit. This means that in many cases in order to achieve a positive result it is absolutely unnecessary to expose each separate atom or lattice point. Only a relevant physical agent, an informational component acceptor, is required to be chosen for the impact. This raises an obvious question what physical agent can be used for these purposes.

The structure frame of a crystal lattice may be presented as some well-ordered periodic field structure. For the first time this idea has been expressed by Erwin Schrodinger – «I am inclined to consider the whole structure of a crystal lattice as something, which is quite similar to de Broglie standing wave. The lattice can obviously be interpreted this way, however such task is extremely complicated because of a very strong interaction of these waves» [17]. In order the exposure on such structure to be effective, it is necessary to ensure information similarity of an impacting agent topology or field structure and crystal lattice structure. A duly structured electromagnetic field is thought to be such rather universal agent. In this case the whole interaction process may be represented as field structures or wave functions interaction. This idea however faces considerable difficulties. To calculate structures of even not very big molecules one should use the values of parameters of about 10^5 , which is not possible and one has to apply “chemical and mathematical intuition” and make “guesses” [18].

Resonance exposure peculiarities

Of special interest are the resonance phenomena where a system response is effected at a frequency different from that of the reference signal. These phenomena include electromagnetic-acoustic transformation, which is observed in colloid systems when an electromagnetic wave reaches their boundary surface. The main point of this phenomenon is the fact that under the influence of an electromagnetic wave ultrasonic waves of the same frequency (linear response) or of multiple frequency (non-linear response) are excited in a substance possessing neither piezoelectric nor magnetostrictive properties. A boundary as the place where the exciting force is concentrated is of fundamental importance. Non ordinary nature of this phenomenon lies in the fact that an electromagnetic wave, which reaches the boundary, excites acoustic oscillations in an electrically neutral body. At this, one has to deal with a range of phenomena since the mechanisms, providing electromagnetic and acoustic waves transformation are quite numerous [19].

At this, a transformation chain may look as follows, for instance: an electromagnetic wave \Rightarrow temperature variations \Rightarrow ultrasound. Moreover, we believe that the spontaneous process of acoustic oscillations generation under thermodiffusion influence is possible. Regarding thermal mechanisms of electromagnetic and acoustic transformation, it is supposed that non-linear interaction is the main point. In this case the frequency of excited ultrasound will be equal to doubled frequency of an incident electromagnetic wave (here we mean non-linear sources hidden in transformation mechanisms) [20].

Ideas of electromagnetic and acoustic transformation became the basis for carrying out test studies of the influence radio-frequency band (about 15 BA) electromagnetic fields exert on various processes and, in particular, on solidification of mineral astringent [21], which originally represent a colloid system. Artificial stone that forms at this passes through a range of structural states and some of them may be represented by temporary dissipative structures.

Most reasonable explanation is believed to be a suggestion that an acoustic wave has structuring influence at a resonance frequency of one of the modes of own oscillations or rotations of structural formations of a medium. An acoustic wave acts as a spatial and dynamic matrix, which arranges synchronous movements of the environment structural formations (molecules, clusters, lattice). An approach based on a percolation tasks group also seems to be quite productive. When in



a clump-conductivity passage astringents solidify, local properties of the medium may considerably differ from average macroscopic ones and the transferring phases boundary acts as an attractor of the percolation channels paths [22].

If a solid body or a biological organism is considered as a quantum wave structure, in order to expose it, it is reasonable to use the phenomenon of resonance with a wave structure, possessing similar properties after a relevant physical agent has been chosen. Electromagnetic field, covering the spectrum from hundreds of meters (radio waves) to fractions of an angstrom (rigid gamma-quantum) represents such universal physical agent. The resonance frequency of interaction can be defined by absorption peaks. Electromagnetic field properties may be dispensed on the field surface in such a way that the conditions for synthesis of nanostructures on molecular level [23] or for a change in biological object properties appear. It is KAM (Kholmogorov-Arnold-Mozer) theory that deals with studying the resonance exposure on different systems. It brings to some very important conclusions. Since particles frequencies depend on dynamic variables, in a phase space, characterizing a system, resonance is recorded in some points and is not in other. In case of chaos resonances cause extremely complicated behavior of a system within the phase space [24].

The fact that by increasing energy we expand the phase space areas where random paths prevail though harmonic oscillations quite often occur, is another important result of KAM theory. In presence of some critical energy values well-ordered oscillations in a system may convert into random ones [25]. Therefore, it is not necessary to aim at increasing exposure energy for obtaining well-ordered structures, it only requires to enhance the structural organization of an exposing agent. It is the scientific school of N.D. Devyatkov- M.B. Golant – Y.V. Gulyaev that has extremely fruitfully dealt with studying the exposure of highly-ordered low-intensity coherent electromagnetic fields mainly of the millimeter spectrum (at frequencies of 30...300 Hz) on biological and physical objects since the 60s of the last century during the long time. Since within this frequency range in physical and biological systems non only electromagnetic but also acoustic and acoustoelectric oscillations and waves are generated and all these types of oscillations transform into each other, a term – extremely-high frequency radiation and oscillations [26,27] – has been introduced and by now it is generally acknowledged. A peculiarity of millimeter waves is that their exposure is apparent under an extremely low nonthermal level of power. Since a very high-frequency spectrum can be used to handle much information, a hypothesis, concerning not energetic but informative and resonance nature of the interaction with a low level power of excitation signals has been suggested.

Since the external radiation power is sufficient to form excitation signals, which energy in any information systems is several times lower than energy of the whole system and extremely-high frequency radiation action does not depend on its wide-range intensity in view of certain parameters, which is natural for information systems and is defined by the specific character of the control process, the authors of these works have given prove to a hypothesis, concerning the fact that penetrating into a biological system at certain frequencies this radiation converts into information signals, which control and regulate certain processes in this biological system [28].

Works of this school prove that information influence of electromagnetic fields on the biological objects is connected with the formation of material structures, while components for such structures creation are not always present in the required area of the biological object (the area where a substructure is being formed). That is why in some cases rather continuous radiation is needed to attain the necessary effect. At this the matter does not concern the time required for the results of forming a new substructure in the biological system becoming apparent but the time needed for its formation. One should remember that electromagnetic waves themselves can't have considerably differing influences on various components of a biological system. Before this they have to transform into acoustoelectric waves in the presence of a transformation system. Such transformation system may be represented by a periodic lattice, the elements of which are displaced relatively to each other for a small distance, coinciding with an acoustoelectric wave length [28].

Electromagnetic fields influence on water



Since water is a significant component of almost all biological objects (a human body consists of water for 62%) and due to its unique properties it can be considered to be a certain bridge between animate nature world and, conventionally speaking, minerals' world, researchers have studied the interaction between MM fields, water and water-containing objects. They have succeeded in finding that water possess a new, hidden before, deep-laid property – a resonance wave state and that “water component of a biological object – resonance electromagnetic MM waves” system plays a critical role in nature. Self synchronizing at resonance frequencies, molecular oscillators of water component of a living organism may represent a natural internal source and conductor of resonance MM-waves. The system of these oscillations forms spatial and time organization of a biological medium structure [29].

When studying the influence a permanent magnetic field has on water structures, it was detected that at frequencies of about 25 and 50 Hz water and biotissues very slightly generate resonance extremely-high frequency waves, though at these frequencies with no magnetic field there is no radio response at the influence of extremely-high frequency waves. Water also appeared to possess long-term orientation-magnetic memory [30]. Alternate magnetic field exposure unlike permanent one may cause a structure-forming impact on dielectric associated liquids and provoke the formation of closed or coiled molecule chains. When water passes through the alternate magnetic field there appear conditions for forming ring (plain, solid) structure associates, which minimize energy of interaction with time-variable magnetic field. The interaction with variable magnetic field may be effected not only through electric dipole molecule moments but also due to axial toroidal moment of macro-molecular associates, the electric dipole moment of which may be equal to zero in general. With view to water such associates formation lowers effective dielectric permittivity [31].

Understanding structural peculiarities of water stimulated studying how mild influences impact its properties. Background radiation and geomagnetic field impact has been detected. Regarding that water as condensed medium constitutes a three-dimensional molecular configuration, which hexagonal fragments possess primary magnetic moments, which are orthogonal to their mutually compensated surfaces, one can make a conclusion that water matrix forms a self-organizing well-ordered fractal structure [32] along with inorganic ions.

An average value of water conductivity change, being exposed to a cellular phone radiation, is equal to 5-10 microampere [41] in accordance with the studies cited in the Report on scientific development “Detecting changes in water conductivity under the influence of a radio phone radiation with and without Electromagnetic abnormality neutralizer” that has been carried out by S.V. Zenin, Doctor of Biology, in Scientific Clinical and Experimental Centre of Traditional Diagnostic and Treatment Methods of the Russian Federation Ministry of Health.

We suppose that only highly-ordered and informationally structured electromagnetic fields (though even extremely weak ones) exert organizing influence on water structures. If in case of powerful influences only rough and powered impact may be expected to be produced on a system, in case of mild and ultra-mild influences unexpected effects and phenomena may be expected due to ambiguous results of external influence on many indestructible functional freedoms of the influenced objects. One can even assume that as the influence power grows its accuracy and capability for structural transformations lowers, thus resulting in the systems' complete chaos through the extremely powerful influence. There raises a question what makes it possible for a biological organism to succeed in keeping so a high level of organization in the course of its living process, where he derives the required information resources. Erwin Schrodinger, quantum mechanics founder, was the first to try to answer this question with relation to physics in his book “What is life. Physical aspect of a living cell”.

A distinctive feature of any living organism from a non-living one or an object of abiocoen is that a biological organism, being an extremely open system, feeds, breathes, assimilates, and exchanges energy with the environment. Since metabolic processes involves nothing mystic or esoteric they should enhance entropy, but since this does not happen within a long period this



means that a living organism somehow manages to get rid of excess of entropy, effectively deriving negative entropy from the environment. Schredinger offered to replace the clumsy concept of negative entropy by a smarter one – entropy with a negative sign, which is the measure of order in itself. Now let's simply cite the great physicist.

“A mean, with the help of which an organism continuously keeps itself at quite a high level of order (and also at rather a low level of entropy) actually consists in permanent deriving order from the environment. This conclusion is less paradoxical than it seems for the first sight. More likely, it is commonplace. Indeed, we rather well knew that type of order of superior animals, which they feed with and, namely: extremely well-ordered matter state in more or less complicated organic compounds serve as food for them. After use animals return these substances in a much degraded shape, which is however not fully degraded since plants may also use them. (For the plants a powerful source of “negative entropy” is represented of course by sunlight)... The amazing feature of an organism to concentrate “order flow”, thus avoiding a transit to atomic chaos, the capability to absorb order from a suitable environment, is possibly related to the presence of “aperiodic solid bodies”, i.e. chromosomal molecules. The latter, undoubtedly, represent the highest level of order among known atom associations (higher than that of periodic crystals) due to that separate function of each atom and each radical, which they fulfill here”.

Reasoning from Schredinger's concept, one can make many interesting suggestions. The first is that geophysical electromagnetic field plays a significant positive role in providing vital functions of biological organisms, since its interaction with an organism causes entropy reduction and as a result an increase in structural complexity of an organism and the level of its order. If electromagnetic field is appropriately informationally structurized and harmonious, i.e. coherently ordered, an organism interaction with such field is extremely useful and favorable. Adaptation is especially important when subforms of a biological organism (and there is no doubt that they are quite well-ordered) enter the resonance interaction with other carriers of ordered structures, including electromagnetic field, since at the resonance interaction counter energy and information exchange occurs under maximum favorable conditions. If electromagnetic field is already adequately structurized and differentiated, this exchange will become much more facilitated. But not only merely wave fields may become the carriers of ordered structures. In abiocoon there are objects with the highest level of structural organization. First of all they are crystals, secondly, they are pure and perfect metals with crystal structure equal in principle to natural crystals. For a long time it has been known that contact between a perfect crystal and a biological organism results in their resonance interaction and increase in structural perfection of the organism. It is natural that the more perfect a crystal is the more favorable is the interaction for an organism. However, it is necessary to note that as a result of nanotechnologies development there have appeared structures, which surpass natural crystals in view of perfection and structural order.

From the point of view of Schredinger any ordered material structure creates periodic electromagnetic field and is maintained by this field. As a result, the most adequate agent of external influence will also be electromagnetic field. To control the self-regulation process of any system its resonance interaction with an exposing factor, in our case with a specially organized periodic fractal electromagnetic field, seems to be most prospective. Such interaction, including resonance of field or living or non-living matter oscillation frequency will promote the process of reorganization in order to stabilize and make more perfect its periodicity (eliminate defects) with minimum energy consumption. Due to fractality principle the resonance interaction is possible not only when the dimensions of a field and object structures coincide but when their scale matchings are multiple. First of all, for effective resonance interaction not the intensity of a substance, influencing the field, but the accuracy in attaining the resonance should be provided.



Fractal-matrix structures action

In 1991, in the course of studying fractal-matrix diffraction lattices impact on a human organism it was found that under the influence of special fractal-matrix structures the functional state of an organism normalizes. Further researches resulted in the creation of a series of topological constructions of flat contact-type elements that were named matrix applicators and in 2001 were acknowledged by the RF Ministry of Health as an official medication (TU 9444-001-48971233-2001). With regard to both structural complexity and technological perfection these flat matrix topologies have been developed and as a result the products known as optical filters and electromagnetic abnormalities neutralizers appeared. The general term used for such structures is fractal-matrix structurizer (FMS). AIRES fractal-matrix structurizers are a curvilinear diffraction lattice, which structure by means of fine-line optical photolithography has been applied on a substrate that is represented either by a monocrystal silicon substrate, or by an optically polished glass substrate or by an organic plastic carrier. Diffraction lattice graphics is represented by a fractal-matrix topology made as a matrix fractally assembled according to a special algorithm and consisting of a strict set of self-similar modules.

In view of optics, the developed graphic modules of fractal-matrix topologies shaped as special electromagnetic radiation structurizers (FMS) constitute complex non-linear diffraction lattices according to theoretical and experimental researches that have been carried out in fractal optics laboratory of S.I. Vavilov State Optics Institute under the supervision of G.S. Melnikov. FMS have been determined to represent graphically synthesized holographic patterns, which create stable spatial structure of regular maximums and minimums of the generated field with harmonious frequency-to-peak ratio. The determining factor of functional properties of matrix graphics specially executed as a flat resonator is a barrier effect of a medium density change, which drastically varies at the boundary of 'a free field' and structural lines. The more this difference is marked the more is the effect of the resonance capability of a scheme fixed in a two-dimension space.

At this, it is not the dimensions of a topology line that are determining but the difference of a substance density in the transition area, which is provided by relevant parameters of the structural lattice of a substance used in matrix material production. Therefore, a specific sputtering technique is used for making the resonators. Another way to provide maximum difference between the characteristics of a medium is the application of 'slit' structures when a matrix topology is executed as grooves of special profile in a substrate surface layer, thus transforming into waveguides for the generation of various surface waves, including waves of soliton type.

One may say that in view of general ray optics devices of FMS type represent an electromagnetic radiation converter and differentiator, which converts random radiation into well-ordered one.

Conducted experimental researches and computer simulation show that FMS converts not only sunlight but also industrial radiation into coherent form, thus allowing an organism to adjust to it. In this view fractal-matrix topologies represent an extremely-high structured diffraction lattice, providing the most expanded interaction with electromagnetic field, at this its coherent conversion is observed in the course of interaction. Thus, fractal-matrix diffraction lattices constitute means of multipurpose conversion of electromagnetic radiation of various types.

Analysis of results of physical, physical and chemical, and medical and biological researches aimed at studying physical nature of the found effect of the influence of fractal-matrix structurizers on various objects and phenomena observed allowed to detect a set of peculiarities inherent to all processes in question that led to developing a range of unique products for effective adjustment of various human pathological states, as well as environment electromagnetic abnormalities.

In this view it is interesting to note a marked impact of AIRES curvilinear fractal matrix diffraction lattices on water media. In direct contact with water medium a process of ordering



molecular cluster structure occurs that, in particular, is shown by a change in the medium's pH with its parameters shift to neutral 7,30 – 7,35. [41].

As a result of the study carried out AIRES fractal matrix diffraction lattices were considered to have an influence on water, changing its structural and information state, due to their capability to structurize broadband electromagnetic field of water, not only by strengthening or weakening it at certain frequency bands but having an impact on its topology. Due to the resonance phenomena at certain frequencies, the interaction of this newly structurized field with original field of water causes a relevant reorganization of water structure itself. Change in structural and information state of water is accompanied by change in its IR spectrum characteristics, as well as its physical and chemical parameters: conductivity and even pH value. Obtained test data bring out clearly that the existing controlled influence of AIRES fractal matrix diffraction lattices on water and, consequently, on various water systems, including a human being, entails a possibility of wide use of the studied phenomena. [42]

In addition, in the course of direct experiments with distilled water under polarized light it was discovered that there exists a phenomenon of hysteresis of recovery of its surface structures optical properties on the boundary with glass when AIRES fractal matrix resonator (FMR), inducing these properties, is brought at a depth and then moved away.

The discovered phenomenon of water optical properties hysteresis may serve as a mechanism of its 'optical memory' phenomenon, which is widely used in medical and biological psychotropic practice.

Experiments have shown that for a layer under a prism, being about 1 micromicron thick and with marked NPVO properties at a wave length $\lambda=632.8$ nm, a refraction index is equal to $n=1,33375\pm 0,00015$ in the presence of AIRES FMR. This means that in this case optical density of this layer is higher than that of ordinary distilled water ($n=4/3$). [45]

Research of cellular phones radiation influence on a biological system

Therefore, it may be stated that biological structures respond to wide variety of electromagnetic fields of very different types and power. New sources of electromagnetic influence, for instance, cellular phones, are included in this range and the nature of their impact can't be differentially isolated and predicted. The only method of assessing impact of this or that influence on biological organisms is to study responses of the organisms to this influence. If in studying this influences some component is successfully isolated and its separate influence is studied, it should be acknowledged as an unordinary success. More often one has to deal with integral influence and complex reaction of an organism to it.

In view of influence on a human organism a cell phone is a device aimed at generating electromagnetic radiation, bearing informational modulation of electromagnetic radiation usually of 900 - 1800 MHz. However, like any electro or radio technical device in the course of its operation it also generates a lot of accompanying stray radiations of quite another spectrum; at this, power of these stray radiations may be quite small. However it does not mean that they are absolutely harmless. It has long been known that cellular phone radiation is rather harmful though the manufacturers do not advertise it due to comprehensible reasons. In the view of a primitive standard approach, its exposure may be weakened by screening, which is senseless in itself. Any screening at a carrier frequency markedly worsens signal reception and transmission, i.e. profanes the main function of a cellular phone – to provide quality communication. This results in the first binding condition of any protective device operation – it should not influence device's service function negatively. Therefore, there is no sense in trying to measure weakening operational radiation influence of protective devices at carrier frequencies of mobile communication – there should be no such influence in principle. According to it, it is absolutely natural that experimental research carried out in Specialized Centre of Program Systems of Scientific Affiliate of the Federal State Organization Research and Development Institution «Vector» attached to the Russian Agency for



control systems, shows that locating AIRES fractal diffraction lattice on a cellular phone case does not influence quality of receiving and transmitting the main signal at a frequency of 900/1800 MHz [35].

Since a cellular phone is a rather complex device it generates electromagnetic fields not only at a carrier frequency in the course of operation as everybody knows. Studying this radiation represents practical interest. In experimental research carried out in the Laboratory of Electrophysics of Water Ecosystems of the Training and Scientific Centre “Monitoring and Rehabilitation of Nature Systems” of St.-Petersburg State Pedagogical University under the supervision of the professor V.V. Alexandrov, it was discovered that along with the main carrier signal at a frequency of 900/1800 MHz a cellular phone generates alternate electric field in the spectrum of 5 - 2000 Hz and alternate magnetic field in the spectrum of 5 - 500 Hz when in “call” and “talk” modes. These fields are recorded with the help of hardware-controlled methods in the near field zone directly over the surface of a cellular phone case within several millimeters (in the range of 0 - 30 mm) and are distributed in space along the phone case in a complicated manner. [36]

Numerous researches revealed that in colloid and liquid systems the effect of electromagnetic acoustic conversion is observed. The effect consists in converting electromagnetic radiation into acoustic one [37-40]. At this, there is no doubt that the energy conservation law is fulfilled and energy of a quantum of electromagnetic field ($E=h\nu_{\text{electr.}}$) is equal to energy of a quantum of acoustic wave ($E=h\nu_{\text{acoust.}}$). It appears from this that an acoustic quantum frequency will be equal to an electromagnetic quantum frequency but their wave lengths will be absolutely different and will be defined by the ratio:

$$\lambda = \frac{V}{\nu}$$

where λ - is electromagnetic or acoustic oscillation wave length, V – speed of oscillation propagation in the studied medium (for electromagnetic oscillation it is equal to light speed).

Tough contact of a system, radiating electromagnetic waves, with a colloid system allows for successful wave conversion (for instance, outlet of an electric radiation generator is directly connected to cement decking or a mould with molten metal), resulting in a significant change in the structure, as well as physical parameters of a material, which has undergone electromagnetic acoustic conversion.

Human brain like the whole human organism represents rather a perfect colloid system with the whole natural range of physical responses inherent to such systems. Attaching an electromagnetic field generator (a cellular phone) or a scanner assembly directly to the head or within several mm from it creates conditions for effective implementation of electromagnetic acoustic conversion immediately in the cerebral structure. At this, it is extremely important that the stated alternate electric and magnetic fields are located in extremely low-frequency spectrum and according to electromagnetic acoustic conversion principles will be converted into acoustic oscillations of low and infra-low frequency, which are extremely negative and destructive for human mentality and cellular metabolism as it has been stated by Robert Wood’s experiments. Prolonged disordered infrasound oscillations provoke the destruction of cerebral tissue and intercellular interaction structure, thus violation the principles of biological organism self-regulation and intracellular homeostasis.

As experiments carried out in St.-Petersburg State Pedagogical University show, applying AIRES fractal diffraction lattices allows to change low-frequency electric and magnetic fields allocation along the whole case of a cellular phone, as well as to change the density of these fields, by restructuring them, which is of particular importance for eliminating the conflict introduced by low-frequency acoustic oscillations into a bioform’s cytostructure.

As for their frequency parameters and namely 0,3 – 0,4 Hz; 4 – 8 Hz; 8 – 13 Hz; 13 – 25 Hz; 35 – 50 Hz, the main frequencies of brain oscillations known as Δ , θ , α , β , γ rhythms are located directly within the area of generation of accompanying stray radiation of a cellular phone (from 5 to



500 Hz). Thus, lack of correlation between oscillations natural for a human brain and those generated by an industrial source (in our case - a cellular phone) provokes a conflict apparent at the level of brain parts' work as disorders of intercentral and regulatory interactions.

Interesting information about negative influence of cellular phones have been obtained as a result of work of several groups of European scientists within EU program «Quality of Life and Management of Living Resources». The results of this work were published in «Risk Evaluation of Potential Environmental Hazards From Low Frequency Electromagnetic Field Exposure Using Sensitive in vitro Methods» (REFLEX) report in 2004 [43]

Below brief conclusions out of this report are cited.

- Under temporary but not constant Extremely Low-Frequency Electromagnetic Radiation exposure DNA fibers in human fibroblasts are torn. 55 (Herein and further on the numbers cited represent references to the corresponding page of REFLEX report).

- After Extremely Low-Frequency Electromagnetic Radiation influence an increase in DNA fibers ruptures in human fibroblasts depended on the age of those examined. 59

- Extremely Low-Frequency Electromagnetic Radiation caused errors in chromosomes in human fibroblast. 67

- Extremely Low-Frequency Electromagnetic Radiation influenced cellular cycle in neuroblastoma cells HBJ69. 74

Extremely Low-Frequency Electromagnetic Radiation caused change in the process of activating phosphorylated regulating protein, binding cyclic adenosine monophosphate (p-CREB - cyclic AMP response element - binding protein).

- Periodic Extremely Low-Frequency Electromagnetic Radiation exposure provoked DNA fibers ruptures in some cellular lines but not in all of them. 183

- Genotoxic effects of Extremely Low-Frequency Electromagnetic Radiation changed, depending on the exposure duration. 183

- DNA fibers ruptures in human fibroblasts occurred under Extremely Low-Frequency Electromagnetic Radiation exposure depended on the radiation dose. 184

- The effect of Extremely Low-Frequency Electromagnetic Radiation exposure was different, depending on a cell type. 184

- The process of DNA ruptures in human fibroblasts under Extremely Low-Frequency Electromagnetic Radiation exposure and their recovery switched as a result of UVL influence and thermal shock. 185

- DNA ruptures generation in human fibroblasts under Extremely Low-Frequency Electromagnetic Radiation exposure depended on cells genetic environment. 185

- DNA ruptures generation in human fibroblasts under Extremely Low-Frequency Electromagnetic Radiation exposure depended on Extremely Low-Frequency Electromagnetic Radiation frequency. 185

- Radio-Frequency Electromagnetic Radiation caused an increase in micronuclear frequency and in number of DNA fibers ruptures in HL-60 cells, depending on radiant energy. 107

- Radio-Frequency Electromagnetic Radiation provoked chromosomal disorders in human fibroblasts. 128

- Radio-Frequency Electromagnetic Radiation caused genotoxic effects in HL-60 through a narrow energy display field, not effecting cellular proliferation, cellular progression and apoptosis. 203

- Radio-Frequency Electromagnetic Radiation induced cellular stress response. 212

However, in addition to the above said unwanted modulations of electromagnetic radiation a much more negative factor, disturbing the processes of a bioform system-wide regulation and intracellular homeostasis, is represented by high-frequency radiation harmonics, constituting absolutely informational modulation of a carrier frequency of 900-1800 MHz. These pulsed signals, bearing semantic load, are not correlated with each other with regard to frequency, peak or phase of



their own modulations. Thus, being rather random in the view of a bioform’s regulative capabilities and unpredictable in the view of selecting a compliance algorithm within the formation of compensatory response to these ultra low and thus most traumatic for homeostasis pulsed signals, these sub-modulations of the carrier frequency are extremely traumatic for a bioform of any type, in particular, of the type defining the central nervous system tissue. Cytostructure is not able to adjust to such super-complicated irritator. It is the random nature and lack of the very tendency to coherency and to the regulation adequate in the view of a bioform that is a feature of industrial electromagnetic radiation distinguishing them from geophysical radiation. Hypercomplicated biosystems are in the state of literal shock and as a result almost fall out of the system-wide regulation of an organism.

In biological studies it is established that it is central nervous system, eyes and gonads that are very sensitive to electromagnetic radiation exposure. At this disorders of cardiovascular, neuroendocrinal, hemopoietic, and immune systems functioning, as well as disorders of metabolic process may be observed. Studies have shown that human reproductive system is very sensitive to electromagnetic field radiation. At this, with regard to men rather a high percentage of impotency cases and testosterone reduction is revealed. In women genital function disorders (toxicosis of pregnancy, spontaneous abortion, partus pathology) may be observed.

Relying on analysis results obtained in researching SEMF MT exposure in the presence of AIRE electromagnetic abnormality neutralizer one may conclude that:

1. Weak electromagnetic field of a cellular phone destructs functional structure of intercentral interaction, thus preventing the adaptive process development and causing functional state of the central nervous system instability.

2. AIRE electromagnetic abnormality neutralizer encourages active adaptive processes development, stable functional state formation with a new balanced structure of intercentral interaction. [44]

Results of the study of AIRE curvilinear diffraction lattices (hereinafter referred to as “Electromagnetic abnormality neutralizer”) carried out by the Doctor of Biology, S.V. Zenin are quite significant.

Exposure period 13.20 - 13.50

Observation period	Changes in water electric conductivity, microampere. Exposure of a computer monitor without a protective screen	Changes in water electric conductivity, microampere. Exposure of a computer monitor without a protective screen in the presence of AIRE neutralizer
13-50 (+)(-)	- 72 microampere	- 0 microampere
13-55 (-)(+)	- 74 microampere	- 0 microampere
14-00 (+)(-)	- 72 microampere	- 0 microampere

Values cited in the Table prove first of all objectivization of AIRE electromagnetic abnormality neutralizer protective action. On the one hand, switching the polarity of a supplied voltage from (+)(-) to (-)(+) causes a small difference in readings, which is expectant after changing current direction, and on the other hand, subsequent switching from (-)(+) to (+)(-) accurately returns the original value, which proves the readings reliability.

Observation period	Kinetics of changes in water electric conductivity, microampere, after radio telephone exposure	Kinetics of changes in water electric conductivity, microampere, after radio telephone exposure in the presence of AIRES neutralizer
17.15-17.20	- 10 microampere	- 2 microampere
17.16-17.21	- 8 microampere	- 3 microampere
17.17-17.22	- 6 microampere	- 2 microampere
17.18-17.23	- 5 microampere	- 2 microampere
17.19-17.24	- 5 microampere	- 0 microampere

Values cited in the Table prove first of all objectivization of AIRES electromagnetic abnormality neutralizer protective action. Kinetics of changes in electric conductivity after radio phone exposure in the presence of the neutralizer shows almost full compensation of the radio phone radiation exposure on the structured state of water. [41]

As it is recorded in experimental researches carried out with the help of electroencephalography, electrocardiography, and Foll's methods, a cellular phone equipped with electromagnetic abnormality neutralizer does not have oppressing influence on the brain structure. It is explained by the fact that keeping integral power of the field signal unchanged(as it is a passive system) it converts its structure, restructuring the whole spectrum of cellular phone radiation into a coherent form, possessing high level of structural perfection, thus allowing a bioform to adjust in a mobile manner and effectively adapt for radiation by introducing a corresponding correction into its own regulative system.

The diagram of changes in the brain bonds when an operating cellular phone contacts the head in comparison with the background brain activity obtained by electroencephalography method is presented in Fig. 1.

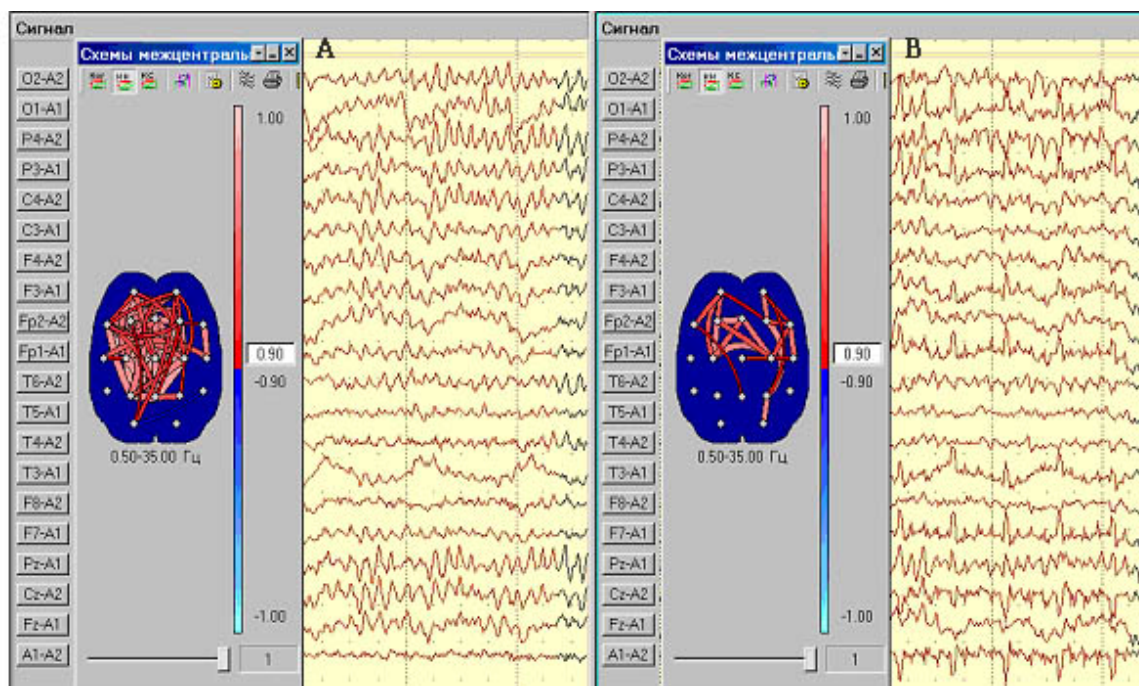


Fig. 1. Diagrams of cerebral intercentral bonds.
A – background record; B – during operation of a cellular phone

The presentation of change in the brain bonds during operation of a cellular phone not equipped with EMAN and of one equipped with it is shown on Fig. 2.

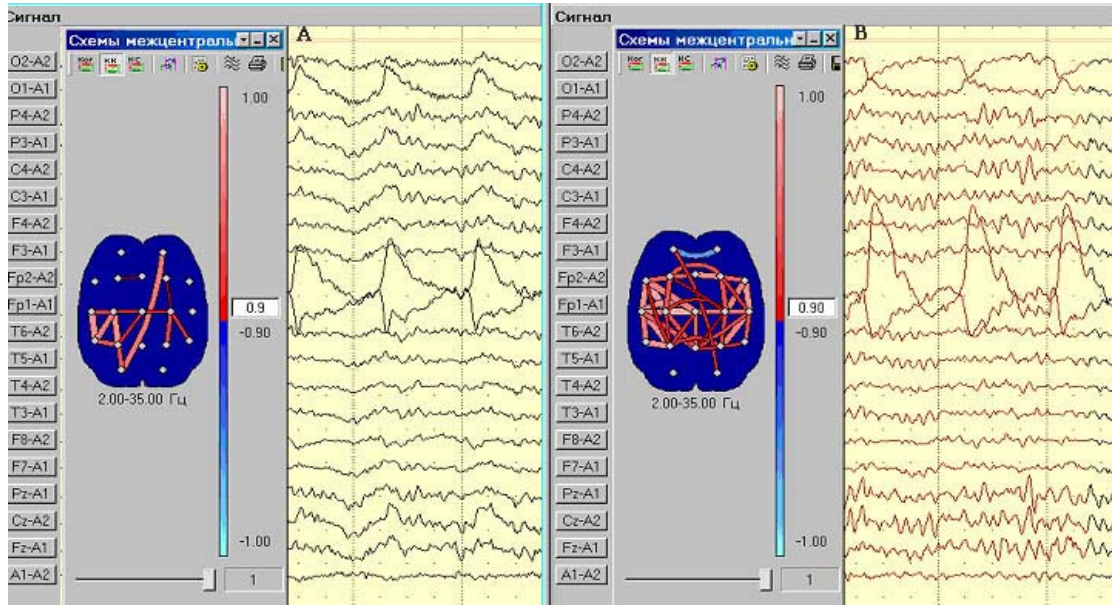


Fig. 2. Typical diagram of changes in cerebral intercentral bonds.
A – after 4-minutes' cellular phone exposure;
B – after 4-minutes' cellular phone exposure in presence of EMAN

The results of an organism's state examination by Foll's method are presented on the following figures. Fig. 3 shows an organism's initial state background image. On the presented diagram each column corresponds to a specific organ indices, which are given in the right part of the bar chart.

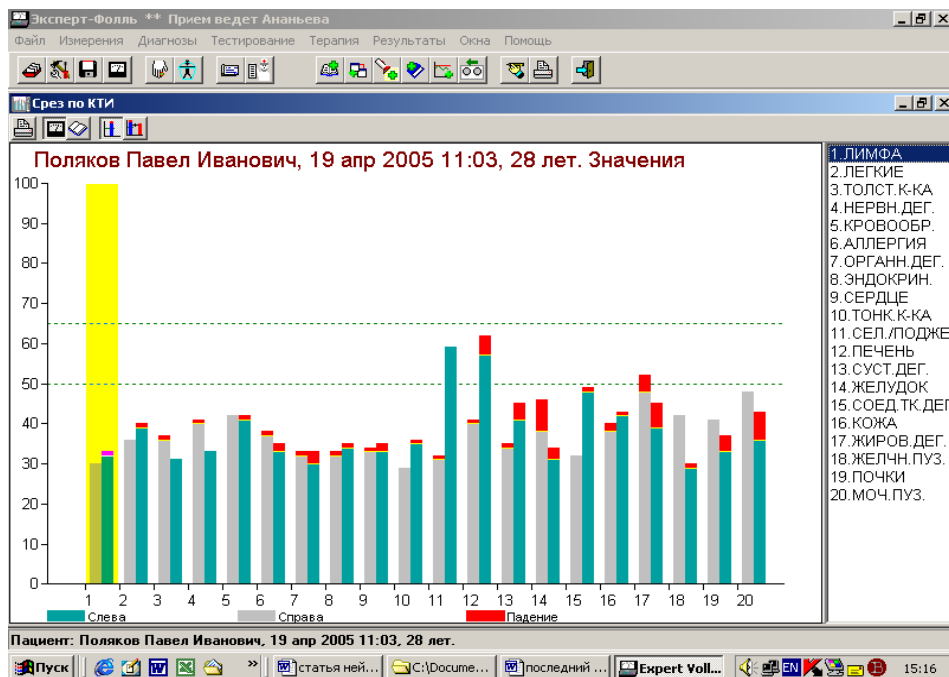


Fig. 3. Initial values of electric potential control measurement points before talking on the phone.
Middle line (at the level of 50 conditional units) according to standard.

The next bar chart (Fig. 4) gives values of electric potential control measurement points when talking on a cell phone. All organs performance deterioration and almost double-reduction of their parameters in comparison with the background values are clear-cut.

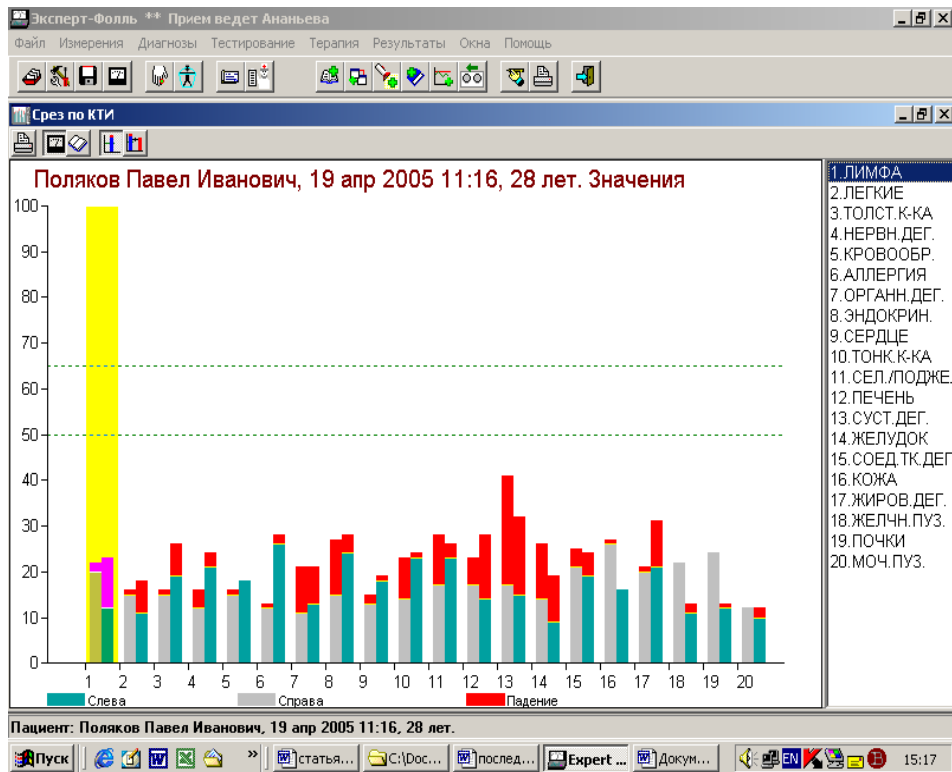


Fig. 4. Electric potential control measurement points when talking on a cellular phone

The next bar chart (Fig. 5) electric potential control measurement points are given when talking on a cell phone equipped with EMAN. All organs performance improvement and recovery to almost the background values are clear-cut.

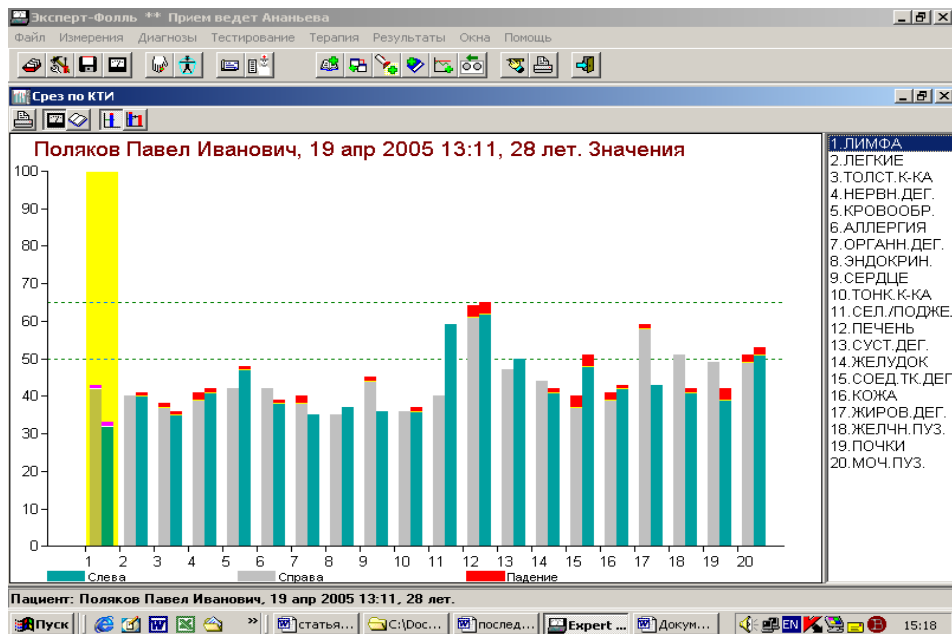


Fig. 5. Electric potential control measurement points when talking on a cellular phone equipped with EMAN

The examined device does not deteriorate reception and transmission but being aimed at a human organism converts radiation into a coherent form, making it more structurally adequate. And as it results from the previous material, the interaction of a highly perfect structure with less perfect one causes entropy reduction and order increase in the less perfect structure. To prove that AIRES fractal matrix diffraction lattices convert background radiation into a coherent form the experiments related to physical-mathematical computer simulation of the process of interaction of scattered radiation with AIRES fractal-matrix topology both in the near-field optical zone and remote one were carried out.

Simulation of electromagnetic wave interaction with the surface of AIRES curvilinear fractal matrix diffraction lattice [45]

Simulation of the electromagnetic wave- AIRES resonator surface interaction (Fig.6) was carried out with the assumption that it is made of silicon material. In the process of simulation some peculiarities of the interaction with radiation of a self-affined surface, which is AIRES resonator surface were revealed.

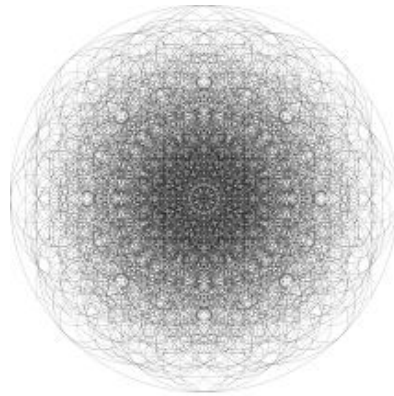


Fig. 6. AIRES resonator surface

At this, the following cases have been studied:

1. Incident radiation influence on charge carriers allocation along the resonator surface, a stationary case
2. Incident radiation influence on charge carriers allocation along the resonator surface, a non-stationary case
3. Incident radiation influence on charge carriers allocation along the resonator surface and on electric field in the space around the resonator surface, a non-stationary case

Incident radiation influence on charge carriers allocation along the resonator surface, a stationary case

For a stationary case electromagnetic wave interaction with the resonator surface may be recorded as:

$$(1) \quad \frac{\partial^2 \mathbf{E}}{\partial \varphi^2} + \frac{\partial^2 \mathbf{E}}{\partial r^2} = \left(k^2 - \varepsilon \left(\frac{\omega}{c} \right)^2 \right) \mathbf{E} ,$$

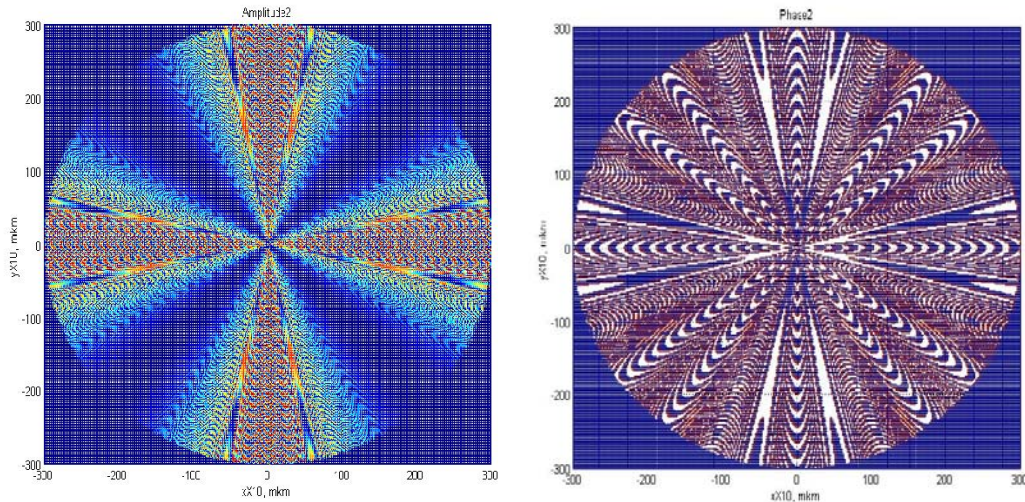
where k - wave number, ε - plate dielectric permittivity, ω - cyclic frequency, c - light speed; r – radius-vector length, φ - polar angle, \mathbf{E} -field vector electric component.

In simulation the following model was used:

$$(2) \quad \frac{\partial^2 E}{\partial \varphi^2} + \frac{\partial^2 E}{\partial r^2} = -a^2 E - b,$$

where E - function proportional to radiation density; r – radius-vector length, φ - polar angle. a and b – constants.

In simulation radiation frequency changed relative to the plate dimensions. Some simulation results are presented in Fig. 7, 8.



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Fig. 7. Results of simulation for incident radiation periodicity equal to 2 cycles per 1 turn over angle φ . On the left – electric field vector amplitude, on the left- phase. Red color corresponds to the highest values, blue – to the lowest.

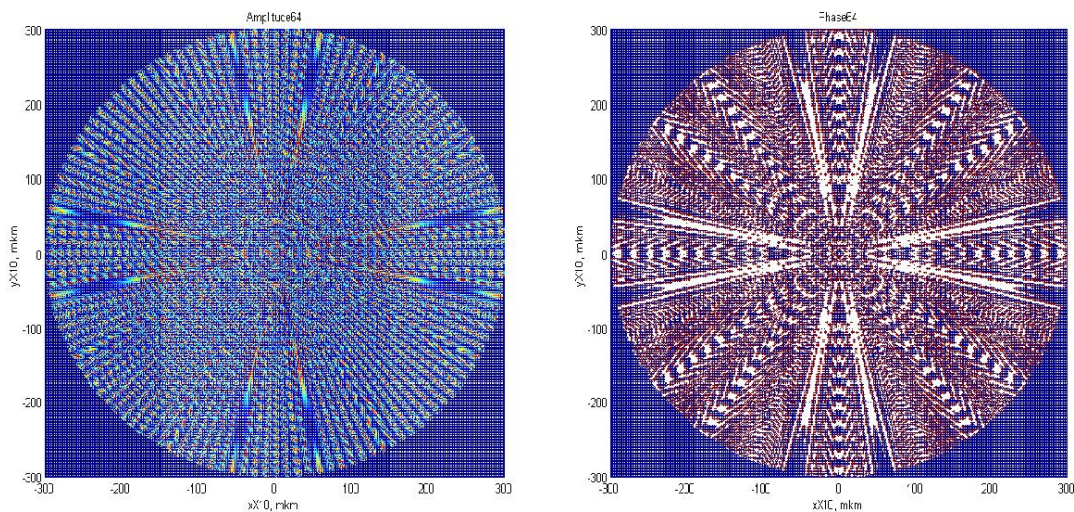


Fig. 8. Incident radiation periodicity equal to 64 cycles per 1 turn over angle φ . On the left – amplitude, on the right – phase.

The results presented show that after the interaction with the self-affined surface the electric field acquires stability, which stays almost unchanged when wide-spectrum incident radiation frequency changes.

Incident radiation influence on charge carriers allocation along the resonator surface, a non-stationary case

Further on the interaction of an electromagnetic wave with the plate surface for a non-stationary case was considered. Taking into consideration that when radiation reaches the silicon surface the phenomenon of shifting occurs, so due to the fact that the plate is thinner in place of grooves location, the charge carriers concentration will be considerably higher than that in the neighboring zones. In plainer terms the charge carriers may be considered to be concentrated in grooves (Fig. 9).

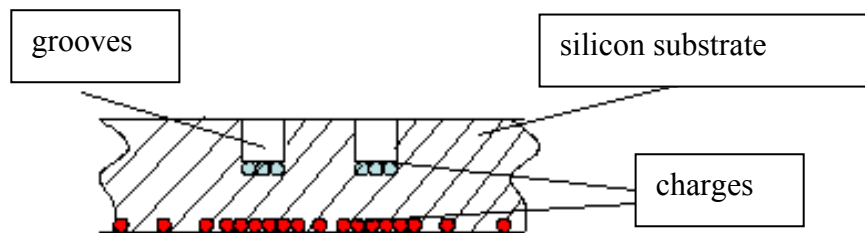


Fig. 9. Quality view of charge allocation.

Let the charges density in two neighboring grooves be equal to q_1 and q_2 , correspondingly, and the potential be equal to φ_1 and φ_2 (Fig. 10).

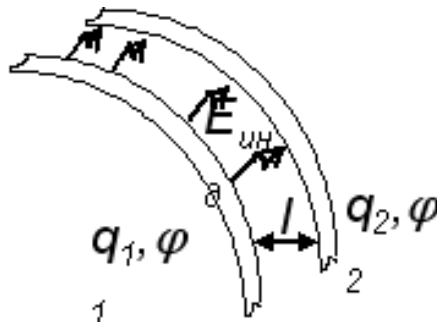


Fig. 10. Charges in neighboring grooves.

When a potential reaches some critical value φ_{kp} there appears a disruption along the shortest distance between the grooves.

A model for this case looks as follows :

$$(3) \frac{\partial E}{\partial t} = D \left(\frac{\partial^2 E}{\partial x^2} + \frac{\partial^2 E}{\partial y^2} \right) - aE, \text{ where } D \text{ and } a - \text{coefficients, } E - \text{electric field density amplitude, } x$$

and y -coordinates, t - time. Disrupture conditions are implemented as follows: if $E > 0,6$, then $E = 0$. Simulation is done for values $D = 0,01$ and $a = 0,001$.

Simulation has shown that regardless of the surface boundary conditions some time t_{yct} later, stable and solitone amplitude distribution along the resonator surface is settled.

One of the simulation results is presented in Fig. 11.

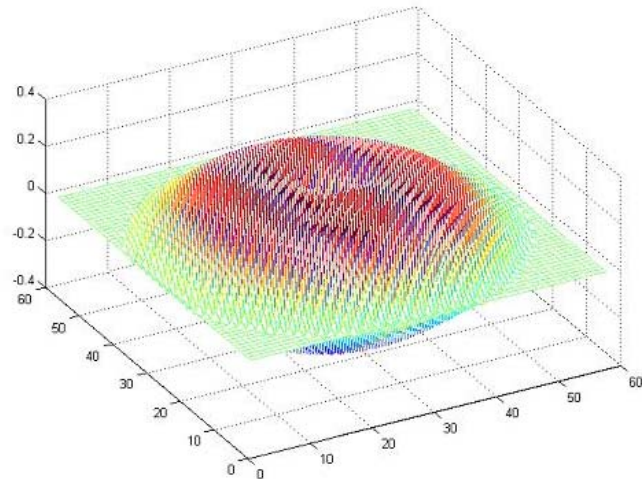


Fig. 11. Amplitude Ψ distribution along the plate surface within the time $t > t_{\text{stab}}$

With regard to the obtained results spatial distribution of the amplitude power spectral density has been defined. The results are shown in Fig. 12.

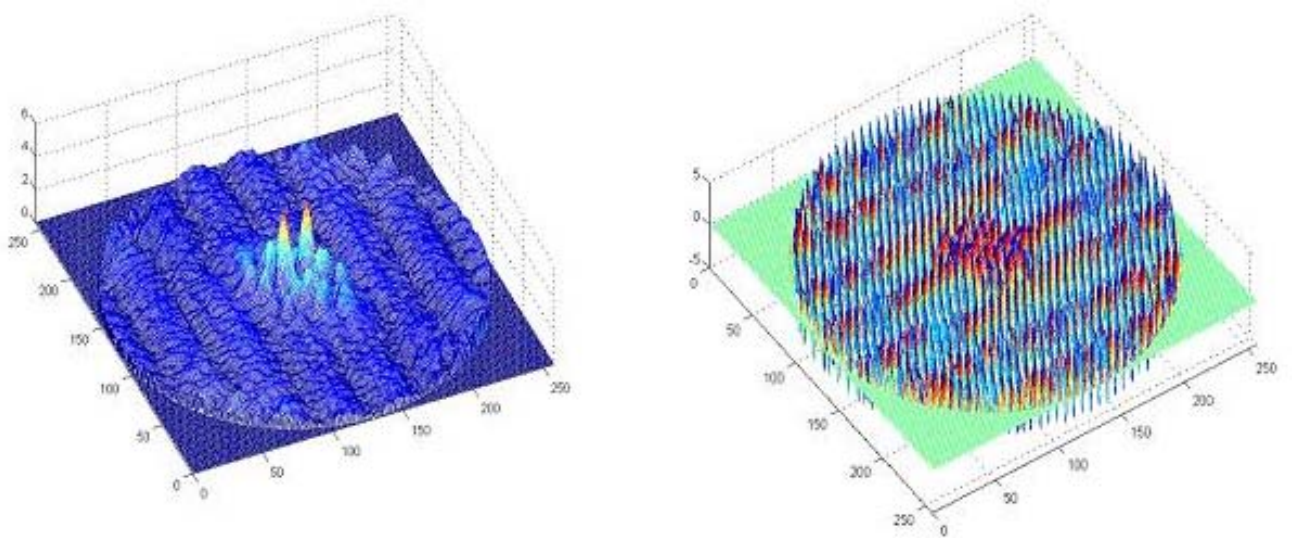


Fig. 12. Distribution of spectral density of the amplitude Ψ power along the plate surface within the time $t > t_{\text{stab}}$. Module – on the left, phase on the right.

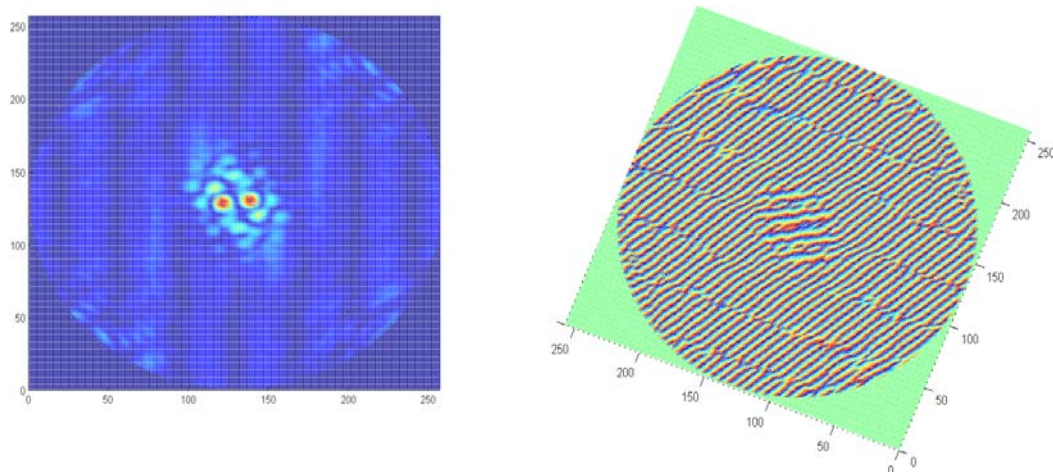


Fig. 12a. Same, top view

The main simulation result is the fact that regardless of the conditions on the boundary the solution is stable and solitonlike. Its shape does not change when the boundary conditions change. This means that the self-affine surface of AIRES resonator resolves radiation so that the result does not depend on the parameters of hitting it radiation.

Incident radiation influence on charge carriers allocation along the resonator surface and on electric field in the space around the resonator surface, a non-stationary case

This case model looks as:

$$(4) \frac{\partial E}{\partial t} = D \left(\frac{\partial^2 E}{\partial x^2} + \frac{\partial^2 E}{\partial y^2} + \frac{\partial^2 E}{\partial z^2} \right) - aE$$

Fig.13 gives one of the results of simulating changes in electric field density *on* AIRES resonator *surface*. Change in electric field density is shown with the resonator surface, being pulse-influenced with electromagnetic radiation.

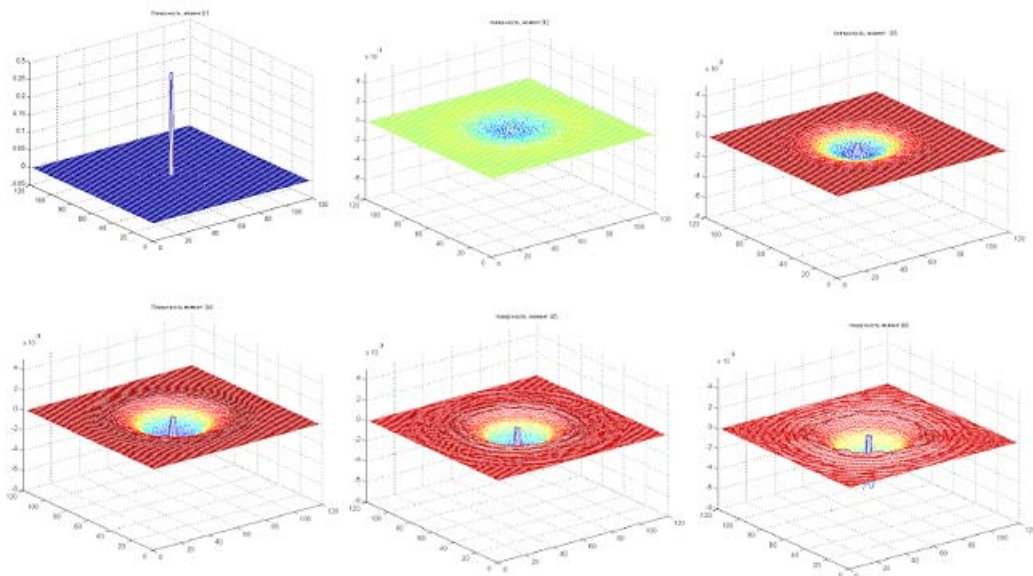


Fig. 13. One of the results of simulating changes in electric field (E) density on AIRES resonator surface.

Top line, from left to right: time points t=0,1,2.
Lower line, from left to right: time points t=3,4,5.

Fig. 14 shows one of the results of simulating changes in electric field density *over* the AIRES resonator *surface* (at a height of 5,5 mm).

Change in electric field density is shown with the resonator surface, being pulse- influenced with electromagnetic radiation.

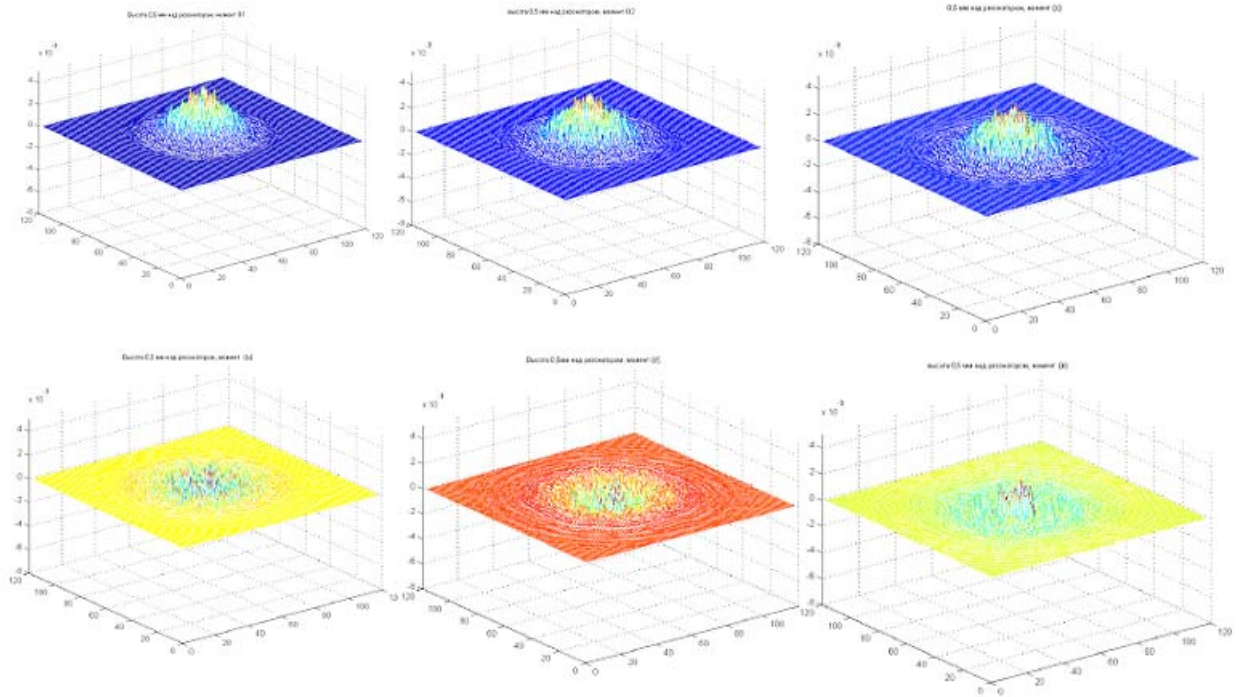


Fig. 14. One of the results of simulating changes in electric field (E) density for a height of 0,5 mm from AIRES resonator surface. Top line, from left to right: time points $t=0,1,2$. Lower line, from left to right: time points $t=3,4,5$.

Fig. 16 shows the same results but in another projection, side view as it is shown in Fig. 15.

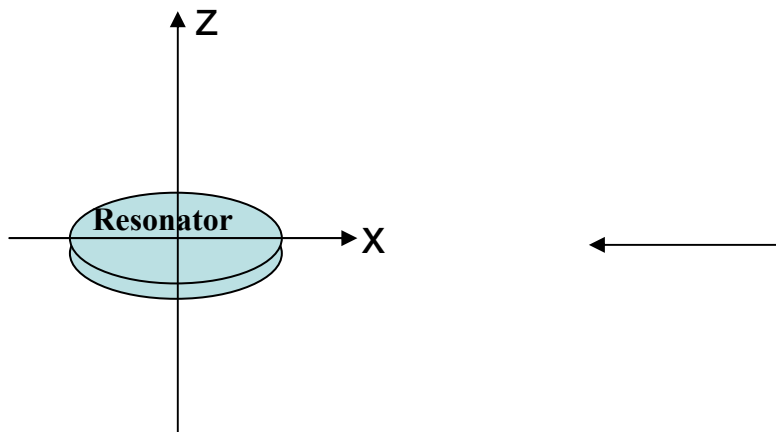


Fig. 15.

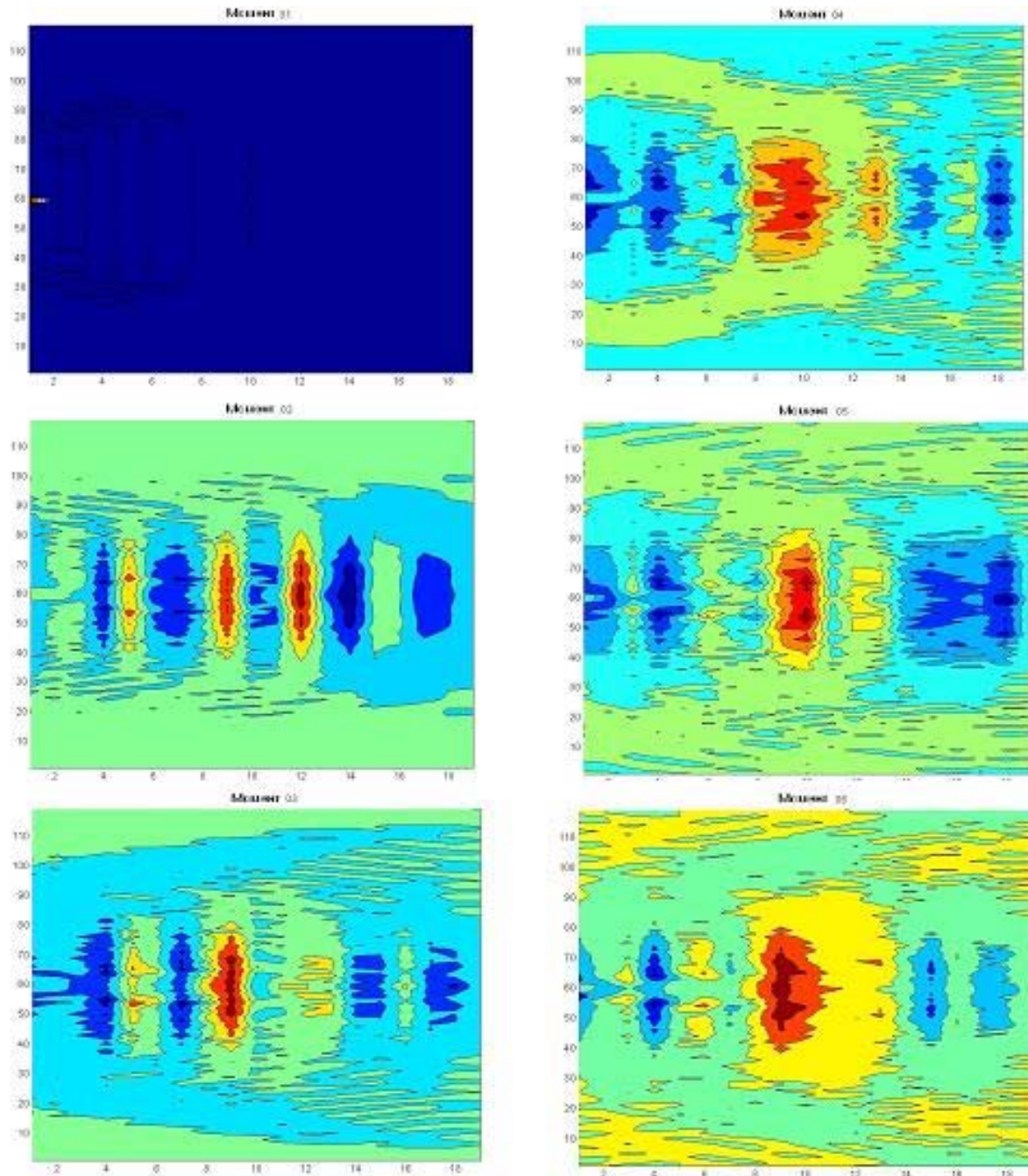


Fig. 16. Change in the electric field density E in time. The resonator is located in the left side of the diagrams, in the centre, along Y -axis from point 30 to point 90. The density E distribution is shown for side projection like in Fig. 15. Simulation is performed for six time points (three left projections, top-down, time points $t=0,1,2$, three right ones, top-down, time points $t=3,4,5$) and for a height from 0 mm over the resonator surface (point 0 x -axis) to 1,9 mm over the surface (point 19 x -axis).

Simulation has shown that the field changes the directional diagram and concentrates in a space zone that can be shown as an imagined tube with a diameter equal to that of the resonator.



Conclusion

1. Being open hypercomplex systems of special type, biological organisms quite actively react on weak and ultra weak electromagnetic fields and radiations both of geophysical and industrial nature. At this, structural improvement degree of these agents manifested by the level of their frequency, amplitude, and phase coherency defines a bioform's capability to simulate its own wide-range adaptive responses algorithm adequately. Otherwise a biological organism's adaptation for this irritator becomes difficult and often even impossible.
2. Screening of biological objects, including human organisms, from background and industrial electromagnetic fields is almost impossible and, moreover, irrational.
3. To stop negative influences on biological objects effected by industrial and background electromagnetic fields it is thought reasonable to convert these fields into a form, which is favorable for biological objects to adjust to them and, in particular, to enhance their structural organization and coherence level.
4. AIREES electromagnetic abnormalities (curvilinear fractal matrix diffraction lattices) neutralizers are ones of the most effective devices for electromagnetic fields conversion into coherent form. As a result, an electromagnetic radiation generator (a cellular phone) equipped with electromagnetic abnormalities neutralizers does not effect oppressive influence on the brain structure, which is confirmed by pilot studies carried out with the help of electroencephalography, electrocardiography and Foll's method (electric potential control measurement points).

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