

Review Article

How does the Geocosmos Control the Viruses in Biosphere: DNA, Ionospheric Microwaves and Water

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Received: November 16, 2022; **Accepted:** January 04, 2023;**Published:** January 10, 2023**Abstract**

The goal of the paper was to show that the phenomena observed in the works of L. Montagnier, the Nobel laureate on physiology, 2008, with the behavior of some bacteria and viruses (including the Human Immunodeficiency Virus), may be related to the effect of microwave fluxes primarily of ionospheric origin, to formation of water-containing complexes.

A well-known mechanism of associative formation is taken into account, taking into account the high affinity for the proton in water molecules. The approach developed in our recent papers is used within the framework of supramolecular physics of complex molecular structures. Supramolecular physics describes a processes developing outside the molecules (atomic-molecular cores) in whose evolution to the complex forms (clusters, associates) electromagnetic radiation of external origin absorbed by excited Rydberg components of molecular complex takes part. Due to increasing value of orbital momentum of Rydberg electrons the stability of the complex grows because probability for forming a stable neutral cluster becomes higher as the electron more seldom penetrates into the ion core. We use the analogy with well known supramolecular chemistry proposed by J.-M. Lehn, the Nobel laureate on chemistry, 1987. He also discussed a possibility of contribution of cosmic influence both to information exchange in living organism and reaction to the environmental stimuli.

The paper presents the following results:

- phenomena in highly diluted water biosolutions, including DNA, are associated with the effect of the constantly existing flux of microwave radiation from the terrestrial ionosphere on the structuring of water molecules. In laboratory experiments of L. Montagnier it was not taken into account that artificial magnetic shielding by 1 mm thick layer of mu-metal absorbs all microwave fluxes of the environment;

- the flux of microwaves of the ionospheric nature is modulated at Schumann frequencies in a ground-ionosphere resonator, primarily at a frequency of about 7 Hz. Its magnitude sporadically increases during periods of solar flares and geomagnetic storms. It is shown that with calm solar-geomagnetic activity, the fluence of the background ionospheric flux of microwaves is really needed for at least 16 hours for the manifestation of water nanostructuring;

- structured pure water and aqueous solutions, including DNA, especially of extremely low concentrations influenced by the microwave flux from the ionosphere, are apparently capable of electromagnetic emission at frequencies below 3 kHz, taking into account the manifestation of ac Stark shift due to the interaction of the Rydberg electron with the external "thermal" field. This hypothesis needs to be refined after analyzing the circumstances of the experiment.

Keywords: Microwave Radiation of the Terrestrial Ionosphere; Rydberg Molecules–Associates; HIV; COVID-19

Introduction

In the research results presented here, we use an approach that was foreseen by D.K. Maxwell [1]: «...The atoms left their heavenly path, and by fortuitous embraces, engendered all that being hath, and though they seem to cling together, and form 'associations' here, yet, soon or late, they burst their tether, and through the depths of space career». The word of *association* was singled out almost 150 years ago by the great author of this poem himself for good reason. In terrestrial conditions: biosphere - troposphere, as well as in the main content of the interstellar medium: interstellar molecular clouds, associates - as a rule, in the form of highly excited polyatomic Rydberg molecules [2], almost prevail! Such a high electronic excitation, up to the level of the ionization potential, i.e. obviously higher than 10 eV, has been known for water molecules and many biopolymers in all phase states [3,4]. In a monograph by Nobel laureate S. Haroche [5] the role of quantum physics in the achievements in the study of microwave phenomena was considered in detail, including the creation in 1985 of a micromaser by the team of H. Walther (co-author of [2]) just on the basis of pioneering approaches [2]. At the same time, in [5], p. 25, it was mentioned the remark made by the Nobel laureate R. Feynman: "No one really understands quantum physics". Nevertheless, in our opinion, we can assume that it was in [2], as well as in [5,6] in 1985, that the microwave energy of complex Rydberg molecules was first studied, with taking into account the results of optical experiments of the group of Nobel laureate H. Herzberg [7], and the theory proposed in [8] and developed for a liquid medium in [9] at the Lawrence Livermore National Laboratory. The end of publications of monographs [3,4] on the Rydberg states of aqueous media and biopolymers also dates back to 1985.

Lifetime of Rydberg states on the scale of physical optics is gigantic [10], p.281, and can reach 10 sec. They are recognized as a reality for a practical proposal in cosmology - space flights based on the energy of space [11,12]. In studying the nature of environmental and biosphere phenomena, we use the idea given by the Russian scientist A.L. Chizhevsky [13], p. 718: "In reality, life is conditioned by the aquatic environment and the colloidal system. The sensitivity of a particular system to the effects of cosmic forces is related to its structure". The approach developed in our papers is used within the framework of supramolecular physics of complex molecular structures. *Supramolecular physics* represents processes developing outside the molecule (atomic-molecular core), in whose evolution into complex forms (clusters, associates) electromagnetic radiation of external origin takes part being absorbed by components of the molecular complex excited to the Rydberg states. As a result stability of the associate (molecular complex) increases due to the increase of the orbital moments of Rydberg electrons. This line of investigation turned out to be effective in applying to the urgent tasks of physics of the environment and solar-terrestrial

relations in order to identify the impact of solar activity factors on weather and climatic characteristics, and on human health. It was shown that the formation of supramolecular systems - clusters (associates) - can radically change both the radiation balance of the atmosphere and the properties of fluids in a living organism. The Nobel Laureate in Chemistry J-M-Lehn in his monograph on *supramolecular chemistry* [14] drew attention to the role of molecular protonics - the transfer of a proton that can have a very high speed. This process makes a fundamental contribution to the bioenergetics of a living organism, directing transport processes and the synthesis of ATP - adenosine triphosphoric acid - a supplier of chemical energy for biochemical and physiological processes in the body. J.-M. Lehn also discussed a possibility of contribution of cosmic influence both to information exchange in living organism and reaction to the environmental stimuli [15].

So, the supramolecular physics developed by us for molecules with a high value of proton affinity made it possible to significantly refine the schemes of the chemical hydrogen "H-bond" [16], proposed a century ago [17] p.1431. Indeed, there was an uncertainty in the very scheme of such an H-bond: namely, with what it begins - either with the transfer of electrons from the composition of the electron shell of an atomic-molecular system, or - with a proton? In our case, which is cardinal for the tasks of biology-medicine, climatology-meteorology, and more recently in cosmology [11,12], wherever the presence of water as a chemical substance is prevalent molecular component - given the high affinity of water molecules for the proton - it seems obvious that the first step is *proton* transfer [16].

The present work concerns the following problems:

- well-known quantum-electron-molecular processes from physical optics are involved;
- water of the body and the electromagnetic field of the environment are considered in the aggregate;
- the mechanisms of induced emission of microwave radiation and collisional non-radiative transfer of excitation energy from water associates to biomaterial molecules, including DNA, in a liquid medium are introduced.

The goal of the work is to involve elementary processes, known from fundamental physical optics, in the development of model approaches for description of current, but still unsolved problems of modern biophysics. These are two problems:

- the growth of association in aqueous biologically active solutions with a high degree of dilution and the effect of electromagnetic shielding on this process [18];

- the behavior of some bacteria and viruses (including the Human Immunodeficiency Virus) [19], including self-assembly with recovery of DNA from molecular fragments.

Basics of Supramolecular Physics

The proposed physical mechanisms are developed starting from 1994, as a part of our research program in the field of physics of solar-terrestrial relations. A new factor of influence namely microwave radiation from the earth's ionosphere is taken into consideration including periods of solar flare activity and geomagnetic storms. In international editions, the first publications were [20,21].

Why do we need to take into account the flux of microwaves from the ionosphere? The fact is that up to date; due to the efforts of world science the variations of all energy fluxes associated with solar and geomagnetic activity have been determined in space experiments [22-24]. The results indicate that these fluxes do not reach the lower atmosphere and, therefore, the direct impact of solar flares and magnetic storms on the biosphere and lower atmosphere is impossible. At the same time, in a number of domestic and foreign radiophysical observations microwave radiation from the earth's ionosphere was detected, sporadically increasing during periods of solar flares and magnetic storms (auroras), see references in [18], but its nature remained unclear. We proposed [25], as a model mechanism for the generation of this radiation, to take into account the most effective channel for the excitation of Rydberg states of atoms and molecules in the upper atmosphere — electron impact by fast electrons. They arise when the ionosphere is ionized by a flux of X-ray and EUV radiation from solar flares and (in periods of magnetic storms) by electron fluxes precipitating from the Earth's radiation belts and directly from the geomagnetosphere. Microwave emission radiation (in the wavelength range from 1 mm to 10 dm, i.e. in the frequency range of the spectrum of electromagnetic waves: EHF-UHF-UHF is generated in allowed electric dipole transitions between sublevels of the fine structure of electron energy highly excited - Rydberg levels with $n \geq 10$ (where n is the principal quantum number) with a change in the orbital quantum number (l) by one, as well as in transitions with a change in n [20]. According to ground-based measurements [26], during solar flares, the signal from the microwave radiation flux of the Earth's ionosphere exceeded the intensity of the microwave flux from the quiet Sun by 2–40 times (at a wavelength of 50 cm) and then the flux of ionospheric microwave radiation is $\sim 3\text{-}70 \cdot 10^{-16} \text{ W / cm}^2$ according to measurement data. During magnetic storms (such observations were made in the auroral zone) the flux can increase up to $10^{11} - 10^{12} \text{ W / cm}^2$ [18].

In 2002, the decisive role of the Rydberg mechanism of generation of microwaves by a disturbed upper atmosphere was experimentally confirmed for the first time on the Russian ionosphere heating stand "Sura", (at radio wave absorption at frequencies of 4.7-6.8 MHz). In this case, the physical interpretation of the observed phenomenon [27] was completely based on the work of [25] given as a result of microwave emission at a frequency of 600 MHz with all the upper-atmospheric gas components excited by the impact of accelerated ionospheric electrons. This result has been verified in the Program HAARP – High-frequency Active Auroral Research Program [28] - analogue of the stand [27], and also proposed in [29] as a variant of artificial control of weather characteristics.

When considering the physics of solar-terrestrial relations as

applied to biophysical problems, two circumstances are important:

- 1) the flux of microwave ionospheric radiation is proportional in terms of energy both flare power and storm strength, that is, it reflects well the degree of current solar-geomagnetic activity;
- 2) the entire spectrum of microwave radiation of solar and ionospheric origin almost freely (with the exception of five narrow absorption bands) penetrates to the Earth's surface, including the biosphere.

Results of our study of the physics of solar-magnetosphere-biosphere links presented below are associated with the involvement of a number of mechanisms at the molecular level, the speed of which can be controlled by the magnitude of the external microwave flux, primarily of ionospheric origin, thus contributing to the formation of supramolecular structures — clusters (associates), primarily from water molecules [18,30,31-33]. This allows, apparently, to talk about a new concept - supramolecular physics (physics of supramolecular structures) in the aquatic environment with the involvement of the known mechanism of associate formation due to the high affinity to the proton in water molecules [2,7].

Processes of Physical Optics Taken Into Account When Interpreting Anomalies Found in Experiments with Highly Diluted Biological Solutions

In [18] attention is drawn to the analogy in the results of experiments with highly diluted biosolutions [34] and in the behavior of some bacteria and viruses (including the Human Immunodeficiency Virus) [19], including self-assembly with recovery of DNA from molecular fragments.

The results of [34] observed during association formation are explained in detail in [33] within the framework of supramolecular physics, taking into account the impact of microwave radiation fluxes from the earth's ionosphere. Its absorption with the excitation of an electron neutralizing the positive charge of the complex ion to the Rydberg orbital with a higher quantum number l increases the number of associating particles, since the probability of penetration of the Rydberg orbit into the ion core decreases, and hence the probability of decay of the resulting associate. When the number of associates with H_2O molecules increases during overdilution, there are more and more opportunities to enhance the biochemical activity of the dissolved biocomponent due to the implementation of collisional - nonradiative transfer of potential energy from the water-containing associate to the Rydberg levels of biomolecules. Therefore, it can be assumed that the increased total microwave flux of quanta of external origin and induced emission can affect the state of Rydberg excitation of biomolecules. Apparently, it was in [18, 33, 35-37] that it was first proposed to explain the concept of a biofield introduced by AG Gurvich [38], primarily of a morphogenic nature, by the contribution of the effect of induced emission of microwave quanta, postulated by the great A. Einstein in 1916. Subsequently, this phenomenon, already in the UV, visible and IR ranges, was widely studied in our country and abroad [39]. One of the works with measurements in 1930 of the glow of the Gurvich AG in the UV range [40] was carried out with the participation of Yu.B. Khariton, who, together with his first deputy K.I. Schelkin (Metakhsyan [41-43]), supervised the creation and testing of the first Soviet atomic bomb on August 29, 1949. At the same time, we attrib-

uted, in full accordance with the approach of A. Einstein, such a glow of biological objects to omnidirectional - spontaneous radiation. Variations in its intensity, including the manifestation of malignant mitosis, were repeatedly measured, including in the form of mitogenetic rays [44], and by AG Gurchich himself. It is important to emphasize two things. Firstly, in 1973 in the Soviet Union, a scientific discovery was registered in Novosibirsk by Academician V.P. Kaznacheev and his school: "Distant Inter-cellular Interaction" [45], which, apparently, has a similar electromagnetic nature. Secondly, in [46] the study of the resonant code of DNA is currently being purposefully developed - with the determination of the role of electromagnetic resonances in the formation of the morphogenic field, with the involvement of the hydrogen bond we are considering in water-saturated DNA. It is interesting to recall here that in 1927, at the "Week of Soviet Scientists" in Berlin, AG Gurchich, when meeting with A. Einstein, asked about a possible explanation for his work. "Einstein advised to just wait until a physical explanation is found" [47] p. 380. This cannot but affect the energy and kinetics of all biochemical reactions, including association formation, with the participation of such excited biomolecules. It is noted that the flux of additional - induced radiation at the same frequencies as the flux of microwaves of external origin, participates, in the framework of the previous scenario of supramolecular physics, in the growth of the rate of associate formation with the inclusion of new water molecules. At the same time, it was confirmed that the use of metal containers in such experiments to shield the geomagnetic field also leads to a cardinal suppression of microwave radiation fluxes of the external environment, including those of ionospheric origin, which only confirms the reality of the proposed channel for the connection of phenomena in the liquid medium of a living organism with the state of geocosmos. In our approach we are grounded on the molecular association process studied in [2], where, according to the measurement of optical spectra [7], it was stated that in the case of the formation of complicated complexes of water, ammonia and methane, the process proceeds through the addition of a proton to their parent molecules due to their high affinity for the proton. Specifically, in [2], p. 457 it is formulated as follows "...polyatomic Rydberg molecules are known... These polyatomic molecules have in common that they can be thought of as being built up from their parent molecules... by adding a proton, which is possible because of their high proton affinity. These ions are then neutralized by capturing an electron in a Rydberg orbital [7]".

It should be emphasized that the processes used by us can actively proceed both in the gas phase and in liquids. In [3,4], T.I, c. 251-253, and T.III, c. 175, 176, it was confirmed that Rydberg states are recorded in the radiation absorption spectra for both water vapor and in condensed media (in liquid water and in ice), while the absorption cross sections are almost the same. Of course, the contribution of collisions with nonradiative quenching of Rydberg states is possible in a liquid [3,4,9,33]. Consequently, a highly excited electron interacts with a neutral only when they are very close and this collision is much shorter in time than in the interaction of charged particles. Since the ion core is far from the Rydberg electron, its presence is insignificant in electron-neutral collisions. In [48], p.210, the time between successive collisions with molecules in an aqueous solution was estimated to be about 10^{-11} seconds. In our case, the average time of the charge neutralization process for a molecular particle, including associates, after the proton attachment is an order of magnitude shorter (in the estimates made earlier

in [33], it is $\sim 10^{-12}$ s), so collisional quenching can be ignored.

As early as in [4], p. 395, attention was drawn to experimental evidence of the presence of Rydberg excited levels in biological materials, and it was noted that "the theory ignores Rydberg excitation". The table presented in [4], p. 396-397, contains such vital biomaterials as DNA, blood cells, oligopeptides, glycopeptides, chloroplasts, etc. It should be taken into account that non-radiative collisional transfer of the potential energy of the Rydberg states to other biomolecular components in second-kind impacts is possible. Here we must bear in mind that the molecules (including those in the cluster-associates) have vibrational and rotational degrees of freedom, which leads to the emergence of a multitude of energy levels. So the conditions of resonances for collisional transfer of potential energy at Rydberg populated molecular levels are practically realizable.

Associate Formation in Biological Solutions of Extremely Low Concentrations in the Field of Microwave Radiation of the Ionosphere

Note that the feature requiring interpretation namely enhanced associate formation, concerns only cases of very low concentrations of biomolecules - less than 10^{-7} - 10^{-10} M, and up to 10^{-18} - 10^{-20} M. Indeed in [34] no significant difference was observed in the rate of associate formation in aqueous solutions of all 60 studied bioactive substances at concentrations from M to $\sim 10^{-7}$ M, both in the presence and in the absence of electromagnetic shielding. We propose the following interpretation of the nature of this phenomenon taking into account the effect of microwave radiation from the ionosphere on the probability of associate formation. In the framework of supramolecular physics, one of the best partners in the mechanism for increasing the rate of associate formation with the participation of microwave flux quanta are water molecules (because of its high affinity for a proton). When the number of water molecules grows with super-dilutions, more and more quanta of microwaves, including induced emitted, participate in associate formation of the water-containing components. Then, more and more opportunities to enhance the biochemical activity of the dissolved bio-components appear due to collisional - non-radiative transfer of potential energy from a water-containing associates to Rydberg levels of biomolecules. In the field of ionospheric microwaves these biomolecules become much more resistant to dissociation because of absorbing a microwave quantum in the transition to a level with increasing magnitude of the orbital moment. This also contributes to the growth of associate formation in the biosolution. So the disappearance of the associative effect under the Permalloy shielding of the geomagnetic field can be considered as a confirmation of our hypothetical explanation, since any microwave fluxes are drastically weakened under the metallic shield.

Consequently, it can be assumed that an increased total microwave flux consisting of external and induced radiation is able to affect the state of electronic Rydberg excitation of biomolecules. The participation of such excited biomolecules in turn can affect the energy and kinetics of all biochemical reactions, including association.

It should be emphasized that there are a number of practically complete coincidence [47] between the conditions necessary for obtaining reproducible results in experiments [19] and [34]:

- the absence of metallic (magnetic) shielding of the studied samples, including clean water and biosolution;

- delay of at least 16 - 18 hours to start the experiment after removing the metallic shield;

- the presence of a working radiation generator with a frequency of ~ 7 Hz, which acts, at least, as an important stimulating factor for the formation of associates in an aqueous biological solution even at dilutions greater than 10^{-9} [34] and under shielding by the metal container. But in [19], in case of such shielding radiation in the ULF-range of 500-3000 Hz (which generates self-assembly of DNA of viruses and some bacteria from low-molecular fragments, including the materials of its donor - human lymphocytes), does not occur earlier than after 16-18 hours of continuous generator operation ~ 7 Hz at room temperature.

The noted similarity of the conditions for the occurrence of the two most unexpected phenomena of recent years in aquatic biological solutions of extremely low concentrations [19,34] allows us to study their nature together, at least at the stage of considering the role of metal shielding and the contribution of the super-large dilutions to the structuring of aqueous solutions of DNA of viruses and bacteria.

The Role of Microwave Radiation from the Ionosphere in Aqueous Solutions of Low Concentrations of DNA of Viruses and Bacteria

Let us give numerical estimates to confirm that for the manifestation of water structuring in experiments [19,34] (after the mode of metallic magnetic shielding), irradiation of the microwaves (fluence) with at least 16 hours is really necessary. Earlier, when determining the contribution of the microwave flux from the ionosphere during the maximum intensity of the world magnetic storm (during the main phase of the storm, corresponding in the auroral zone to the fourth international aurora class (IBC IV)) to the formation of clusters of water molecules in the optically thin cirrus cloudiness, we calculated [32] that the number of such clusters is about 1000 times higher than the experimentally obtained (background) densities in "young" cirrus clouds [49]. On the other hand, for a period of calm global geomagnetic activity in the auroral zone, there are almost always (on average every few hours) substorms are observed, which can be clearly seen from space in manned orbital flights. This provided the reason for astronauts conclusion about the almost constant existence of auroras [50]. Therefore, we assume that the background aurora has an IBC I in the international scale, and the microwave flux in this case is 1000 times smaller than the maximum we have adopted for the main phase of the global magnetic storm. However, in the case of such weak auroras, it is necessary to take into account the contribution of collisional quenching of Rydberg excited states in the lower ionosphere [51] and below ~ 115 km. Indeed, in the case of weak geomagnetic activity, the precipitation of electrons in the ionosphere is not only very small, but their spectrum becomes much harder than during the period of the main phase (with usual duration 6-7 hours [32], p. 280) of world magnetic storms [22], p. 299. Then, taking into account the contribution of absorption (by a factor of e) the usual (background) fluence of the microwave radiation flux of the ionosphere, sufficient to ensure experimentally obtained densities of water particles in "young" cirrus clouds [49] is achieved in $(6 \text{ hours} \cdot 2.72) = 16.3$ hours, which quite satisfactorily corresponds to the delay time in the observed effects ("16 - 18 hours"), both in [19] and [34].

On the Contribution of the Thermal-Equilibrium (Black-body) Radiation of the Environment to Anomalous Effects in

Aquatic Biological Solutions at High Dilutions

It can be assumed that more than a decade of "global" rejection, in fact, suppression [19] of the unique scientific results of the work of a group of researchers by Nobel laureate (2008) Luc Montagnier from the World Foundation for AIDS Research and Prevention (UNESCO) could have led to the situation in the modern covid pandemic, to create a vaccine against HIV infection. By the way, already on April 20, 2020, i.e., at the beginning of the Covid-19 epidemic, this world-famous scientist announced his opinion that the covid virus is the result of manipulation with the HIV/AIDS virus.

Indeed, back in 1985, just in the year of the absolute peak of the main short-wave activity of the Sun over the past centuries, Luc Montagnier himself deciphered the genome of the AIDS virus, and then, while searching for vaccines for HIV/AIDS-infected people, his scientific group unexpectedly (see details in [19] and also the analysis in [47]) found [19] that after fragmentation and filtration, such a virus is capable of self-reproduction. At the same time, the process of "building" its DNA from the remaining fragments of a small size takes place (in laboratory experiments, fragmentation was at least 20 nm), and the missing fragments are synthesized according to some internal program, but as a result, the virus itself or some of its new mutants were reproduced. Naturally, this phenomenon, the participants of the work believed, did not make it possible to have an AIDS vaccine. This phenomenon was observed only in the absence of metal shielding, mainly at high and ultra-high water dilutions, in filtrates from cultures of various microorganisms - not only viruses, but also a number of bacteria, while usually there was associated radio emission of the Ultra-Low Frequency (ULF) range at frequencies of 500 - 3000 Hz. In [19], they came to a controversial assumption about the connection between the problems of obtaining a vaccine against the AIDS virus and the ability of some viral DNA sequences to emit ULF radio waves, which was also found in influenza and hepatitis C viruses. Hence having a very low viral load in their plasma.

Our study showed [52,53] that all the conclusions about the "unexpected behavior" of DNA viruses are quite explicable within the framework of the known processes of the physics of the interaction of electromagnetic (microwave) radiation with the water-containing medium of a living organism, which have already been quantitatively considered taking into account the Rydberg excitation in a number of biophysical applications. We explain the phenomenon of viral DNA synthesis [19] by the fact that it can be supported by the stimulating effect of microwave irradiation on the association of water molecules and biopolymers. Our study allows us to state that the energy from the environment in the microwave range can be the cause of all the observed effects in experiments [19]. Indeed, quantum mechanical estimates [18,32,33] quantitatively confirmed the contribution of the absorption of microwave fluxes from the ionosphere inside the skin layer (thickness from fractions of a mm to 16 cm) to 26% in the process of associate formation in biosolutions, including in the human body, at the maximum of a magnetic storm. This effect, determined by the high proton affinity of water molecules, under conditions of ultrahigh water dilutions (up to concentrations of 10^{-15} - 10^{-18} M), enhances the biochemical activity of the dissolved biocomponent due to the implementation of collisional transfer of potential energy from the high-energy levels of biomaterials, including DNA, which also affects the kinetics of all chemical reactions, including association formation [18].

Experimentally observed phenomena in biological solutions of extremely high dilutions were noted in [52, 53], which can be explained taking into account the effects of thermal (blackbody) radiation at room temperature in laboratories. It is known [6], that at the temperature about $T \sim 300$ K this radiation has a peak of the spectral density in the IR region ($\sim 10 \mu\text{m}$) and slow density fall to low frequencies in the microwave range. Due to the unusually large size of the matrix elements of electric dipole transitions between closely spaced Rydberg levels, this radiation leads very effectively to two effects: induced radiation and energy shifts of electronic levels, while the probability of induced radiation at large magnitude of I is an order of magnitude greater than that of spontaneous transitions. The level shifts are called *ac Stark shifts* because they occur in the electric field of the incident wave; they depend on T^2 [6]. The matter is that the spectral energy density distribution of the blackbody radiation at 300 K has its maximum at about $2 \cdot 10^{13}$ Hz while a transition between two Rydberg states has about 10^{11} Hz. Therefore such a Rydberg atomic-molecular particle appears to be placed in rapidly varying field that leads to an *ac Stark shift* of the Rydberg levels. "Since the bulk of the thermal field spectrum has frequencies much higher than the characteristic Rydberg electron ones, this shift can be shown to be quasi-independent of the electron binding energy (for $n > 20$) and can be interpreted as the mean vibration energy of a free electron in the blackbody field, being the same for all Rydberg states (2.4 kHz at room temperature [6]", p.355).

The available data [19] do not yet allow full interpretation for the possible contribution to the spectrum of Stark modulation with regard to such a shift, as well as the picture of the beats. But it is possible, in connection with the estimates given in [6], p. 355, as well as in [2], p. 439, to assume that Ultralow-Frequency (ULF) emissions lower than 3 kHz, which were recorded in [19], are associated with the *ac Stark shift* effects. By the way, the authors themselves [19] offer a theoretical interpretation of the observed effects in the environment of viruses and bacteria, just assuming the formation of some hypothetical structures in solutions - "coherent domains", while for water in [19] take into account the highly excited state "with energy ~ 12.06 eV just below the ionization threshold (12.60 eV) [19], p. 6", that by definition refers to the Rydberg states of a water molecule.

As for radiation with a frequency of ~ 7 Hz, as an important stimulating factor (both for the formation of associates in an aqueous biosolution [34] in the presence of a metal shielding container, and for the appearance of ULF radiation in the range of 500-3000 Hz [19]), it is required 16 - 18 hours of continuous operation of the generator of this frequency at room temperature i.e. in conditions of irradiation with blackbody radiation of the environment.

About the Possible Proximity of the Nature of Viral (Influenza and Covid) Pandemics

In [36], based on the research of leading Russian epidemiologists, Professor IA Gundarov and Academician AG Chuchalin discovered waves in the modern covid pandemic: "March-April", "end of September-October", "from November to January". IA Gundarov cites "a classic example of aircraft carriers floating offline for half a year ... and suddenly, at the same time, they have outbreaks of infection, 600 people, 800 people," while a direct connection between covid-19 and geomagnetic storms has already been confirmed using the example of outbreaks of an increase in the number of infected in Moscow on June 18-19 and 24-26, 2021, since "it was on June 17 and 25 that powerful

magnetic storms were recorded." According to the data [54], an unusually high asymmetry in the excess of the total area and number of sunspot groups in one of the solar hemispheres - with a sharp transition from the end of 2019, is also close to the 100% level (in May - July 2021 year), into the southern hemisphere and up to most of the first quarter of 2021 already. Since the Earth's magnetic field is also directed from South to North, the prevalence of polar coronal holes in the southern hemisphere of the Sun led to an increase in geomagnetic activity with the appearance of powerful magnetic storms in June 2021. Consultations of the head of the Synoptic Program of the NSO of the USA, Dr. A.A. Pevtsov showed that even a century ago, during the "Spanish flu" pandemic, according to the site [<https://www.bis.sids.be/silso>], northern asymmetry was detected in the number of sunspots from the middle of the first half of 1913 to the middle of 1919, which then changed for almost two years (from the middle of the second quarter of 1919 to the end of the first quarter of 1921) to the southern one; thus, even in those distant years, the outbreak of the viral pandemic (flu) corresponded mainly to the southern location of solar spot activity, like covid-19, when there was a sharp transition to the southern hemisphere: from the end of 2019, close to 100% level (in May - July 2021), lasting up to most of the first quarter of 2021 already. Gradual weakening of the influenza epidemic 1918/20 occurred with the superiority of sunspots in the northern hemisphere (from the middle of the second quarter of 1919 to the end of the first quarter of 1921). In the light of these comparisons, we in [36] received a justified forecast that the return of sunspot activity at the end of the first quarter of 2021 to the northern solar hemisphere is a 100% sign of a weakening of the current helioepidemic covid situation. At the same time, the Sun controls both pandemics: influenza and covid-19 in the same way - through an increase in the number of geomagnetic storms, and, consequently, a sharp - up to four thousand times, amplification of the microwave radiation fluxes of the earth's ionosphere from a height of more than 100 km, as in the zone of polar auroras, as well as at mid-latitudes. This means that *practically at all latitudes*, in both the northern and southern hemispheres of the Earth, the entire biosphere is under microwave radiation. If there is also an anthropogenic source of microwaves: from mobile communications, computer and household appliances - with a close level of electromagnetic background [55], then conditions appear for the implementation of stochastic resonance - the collection of energy of the emission ionospheric microwave flux at anthropogenic operating frequencies [56].

Conclusions

- 1) All life on Earth is in the field of the microwave flux from the ionosphere, the intensity of which is completely determined by the current level of solar-geomagnetic activity.
- 2) The ionospheric microwave flux contributes to the creation of water-containing clusters (associates) in the liquid medium of organisms.
- 3) Aqueous associates can have Rydberg excitation (to energy levels ≥ 10 eV), which can be transmitted to many biomaterials in solution, including DNA, due to collisions.
- 4) The formation of Rydberg biomolecules grows at ultra-high dilutions of biological solutions, due to the increase in the number of water associates.

- 5) Rydberg energy levels in the field of thermal radiation of the environment undergo *ac* Stark shift, which can lead to ULF radio-emission of less than 3 kHz.
- 6) Possible solutions are proposed within the framework of accounting for the interaction of microwave radiation with components of aquatic biological solutions of such problems of modern biophysics as enhancing the effect of association with ultrahigh dilutions and the phenomenon of recreating (after splitting into fragments) the DNA sequence of viruses and some bacteria.

About Recommendations

1. In the Russian Federation, in connection with the concerns expressed recently by both teachers and parents, as well as with the opinion of the country's Prosecutor General's Office, in September of this year, the City Parliament of St. Petersburg adopted an Appeal to the Government of the Russian Federation with a request to ban the installation of mobile cellular telephony repeaters near hospitals, kindergartens, etc.
2. It is planned to develop biophysical studies of the consequences of the cumulative microwave impact both within the framework of heliobiology (at the present stage of the decline in the level of solar-geomagnetic activity), and taking into account the resonant mechanisms of increasing anthropogenic exposure at the frequencies used, with the organization of local control of the level of exposure to microwave sources, and/or taking into account the data of the world network for monitoring the current solar-geomagnetic disturbances.

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References

1. Maxwell JC Molecular Evolution. Belfast: 1874.
2. Gallas JAC, Leuchs G, Wallher H, Figger H. Rydberg atoms: High-resolution spectroscopy and radiation interaction-Rydberg molecules. *Adv At Mol Phys.* 1985; 20: 413-466.
3. Robin MB Higher excited states of polyatomic molecules. V. I. New-York, London: Academic Press. 1974. 374.
4. Robin MB Higher excited states of polyatomic molecules. V. III. New-York, London: Academic Press. 1985; 465.
5. Haroche S, Raimond JM. Exploring the quantum. Atoms, cavities, and photons. New-York: Oxford Un. Press. 2006; 605.
6. Haroche S, Raimond JM. Radiative properties of Rydberg states in resonant cavities. *Adv At Mol Phys.* 1985; 20: 347- 411.
7. Dabrowski I, Herzberg G. The electronic emission spectrum of triatomic hydrogen. 1 *Can J Phys.* 1980; 58: 1238-1249.
8. Bates DR. Electron-ion recombination in an ambient molecular gas. *J Phys B At Mol Phys.* 1981; 14: 3525-3534.
9. Morgan WL. Computer experiments on electron-ion recombination in an ambient medium: gases, plasmas and liquids. Recent studies in atomic and molecular processes. Ed. AE Kingston. New-York, London: Plenum Press. 1987; 149-166.
10. Mironova GA. Condensed state of matter: from structural units to living matter. M.: Physical Department of MSU. 2004: 532.
11. Avakyan SV, Baranova LA Using the results of supramolecular solar terrestrial physics in solving cosmological problems: 1. Experimental background. 2. Model description. Proceedings of XXV All-Russian annual scientific conference "Solar and solar-terrestrial physics". Eds. Stepanov AV, Nagovitsin YuA, 4-8 Oct. 2021; GAO RAS, Pulkovo. 2021: 23-30.
12. Avakyan SV, Baranova LA. Microwave energetics of interstellar/interplanetary space: Model write-up. Proceedings of XXVI All-Russian annual scientific conference "Solar and solar-terrestrial physics". Eds. Stepanov AV, Nagovitsin YuA, 3-7 Oct. 2022; GAO RAS, Pulkovo. 2022: 331-336.
13. Chizevskii AL. The cosmic pulse of life. Moscow: Mysl'. 1995: 768.
14. Lehn JM. Supramolecular chemistry. Concepts and Perspectives. Weinheim, New-York, Basel, Cambridge, Tokio: VCH Verlagsgesellschaft mbH. 1995.
15. Lehn JM. Towards complex matter: chemistry? Chemistry! Video Lecture 26.06.2015. In Book of Abstracts of Plenary Lectures. Ninth St. Petersburg Nobel Prize Laureates Meeting, June 22-26, 2015; St. Petersburg: Russia. 280.
16. Avakyan SV, Baranova LA. Molecular protonics and supramolecular chemistry, physics and biophysics. Invited Lecture. In Book of Abstracts of XXI Mendeleev Congress on general and applied chemistry. Symp. of UNESCO "Self-Assembly and Supramolecular Organization". Saint Petersburg: 2019; 6: 216.
17. Latimer WM, Rodebush WH. Polarity and ionization from the stand point of the Lewis theory of valence. *J Am Chem Soc.* 1920; 42: 1419-1433.
18. Avakyan SV, Baranova LA The influence of microwave radiation from the geocosmos on the state of a living organism. *IOP Conf. Ser.: Earth Environ. Sci.* 2021; 853: 012003.
19. Montagnier L, Aissa J, Del Giudice E, Lavallee C, Nedeschi A, Vitello G. DNA waves and water. *J Phys: Confer Ser.* 2011; 306: 012007.
20. Avakyan SV New possible mechanism of sporadic ionospheric radioemissions. In Book of Abstracts of papers presented at the 25-th General assembly of URSI. August-Sept. 1996. France. G1. Ionospheric models and indices. 2006: 136.
21. Avakyan SV. Optics in the global changes of environment. *Armenian J Phys.* 2009; 2: 15-35.
22. Avakyan SV, Vdovin AI, Pustarnakov VF. Near-Earth space ionization and penetration radiations. Handbook. Saint Petersburg: Gidrometeoizdat. 1996; 501.
23. Avakyan SV, Andreev EP, Afanas'ev IM, Leonov NB, Savushkin AV, et al. Creating of the permanent Space Patrol of ionizing solar radiation. In: "Innovative Telescopes and Instrumentation for Solar Astrophysics", Eds. SL Keil (NSO), SV Avakyan (SOI). Proceeding of SPIE. 2002; 4853: 600-611.
24. Schmidtke G, Avakyan SV, Berdermann J, Bothmer V, Cessateur G, et al. Where goes the Thermospheric Ionospheric GEospheric Research (TIGER) Program do?. *Adv Space Res.* 2015; 56: 1547-1577.
25. Avakyan SV, Serova AE, Voronin NA. The role of Rydberg atoms and molecules in the upper atmosphere. *Geomagn Aeron.* 1997; 37: 331-335.
26. Troitskii VS, Starodubtsev AM, Bondar' LN, Zelinskaya MR. Stre-

- zhneva KM, et al. Search for sporadic radio emission from cosmic space at centimeter and decimeter wavelengths. *Radiophys. Quant Electron.* 1973; 16: 323-341.
27. Grach SM, Fridman VM, Lifshits LM, Podstrigach TS, Sergeev EN, Snegirev SD. UHF electromagnetic emission stimulated by HF pumping of the ionosphere. *Annales Geophysicae.* 2002; 20: 1687-1691.
 28. Leyser TB, Wong AY. Powerful electromagnetic waves for active environmental research in geospace. *Rev Geophys.* 2009; 47: 1-33.
 29. Avakyan S, Voronin N, Troitsky A, Chernouss S. Possibility of weather and climate change by active experiments. 40-th COSPAR Scientific Assembly. 2014. Moscow: C5.1-0025-14.
 30. Avakyan SV. Physics of the solar-terrestrial coupling: results, problems, and new approaches. *Geomagn. Aeronomy.* 2008; 48: 417-424.
 31. Avakyan S. Supramolecular physics of the ionosphere – biosphere links. In *Book of Proceedings of 11-th Intern. School and Conf "Problems of Geocosmos" 2016*, SPbSU, Eds. Semenov V, Kholeva M, Apatenkov S, Bobrov N, Kosterov A, Samsonov, A. Smirnova N., Yanovskaya T.. SPb.: SPbSU, 2017: 180-186.
 32. Avakyan S. Environmental supramolecular physics: climatic and biophysical effects. *Herald of the Russian Academy of Sciences.* 2017; 87: 276-283.
 33. Avakyan SV, Baranova LA. The influence of environmental electromagnetic radiation on associate formation in aqueous solutions. *Biophysics.* 2019; 64: 7-13.
 34. Konovalov AI. Formation of nanoscale molecular ensembles in high diluted water solutions. *Herald of the Russian Academy of Sciences.* 2013; 83: 136-141.
 35. Avakyan SV, Baranova LA. Microwave radiations in oncology: About possibility of inhibition of malignant mitosis. *Actual.Vopr. Biol., Fiz. i Khim.* 2020; 5: 680-688.
 36. Avakyan SV, Baranova LA. Microwave radiation of the environment and the problem of modern viral diseases. *Herald Rus. Acad Sci.* 2022; 92: 177-187.
 37. Avakyan SV, Baranova LA. Microwave radiations of environment: In the possibility of inhibition of malignant mitosis. *J. Clinic. Images and Med. Case Rep.* 2022; 3: 7820/2013.
 38. Gurwitsch AG. The principles of the analytic biology and the theory of cellular fields. Moscow: Nauka. 1991: 287.
 39. Samoilov VO. Medical biophysics. Textbook for the Universities. 3rd edition. Saint Petersburg: SpetsLit. 2013; 591.
 40. Chariton J, Frank G, Kannegiesser N. *Über die Wellenlänge und Intensität mitogenetischer Strahlung.* *Naturwissenschaften.* 1930; 19: 411-413.
 41. Martirosyan GK. Shchelkin Kirill Ivanovich (Metaksyan Kirakos Ovanesovich), Thrice Hero, secret Armenian, unknown to the people. Yerevan. Publishing house Zangak-97. 2009; 199: 2009.
 42. Golubkov GV, Avakyan SV, Berlin AA, Bessonov AV. Legend of the Atomic Project and one of the creators of the nuclear missile shield of the Soviet Union. *Chemical Physics.* 2021; 40: 3-7.
 43. Avakyan SV, Bessonov AV. The key figure of the Atomic Project of the USSR and one of the creators of the country's nuclear missile shield. Proceedings of the Second All-Russian Scientific and Practical Conference "Scientific Readings in Memory of Academician V.P. Glushko", St. Petersburg: 2021; 79-84.
 44. Naumova AV, Naumova AE, Isaev DA, Volodyaev IV. Historical review of early researches on mitogenetic radiation: from discovery to cancer diagnostics. *J Biomedical Photon. Engineering.* 2018; 4: 040201.
 45. Kaznacheev VP, Mikhailova LP. Bioinformational function of natural electromagnetic fields. Novosibirsk, Nauka-Siberian Branch. 1985:181.
 46. URL: <https://dnaresonance.org/p/>
 47. Gall' LN. Physical principles at the functioning of the substance for living organism. Saint Petersburg: Publishing-house of SPb. Politesh. Un. 2014: 399.
 48. Binhi VN. The magnetobiology. Experiments and models. Moscow, MILTA. 2002: 592.
 49. Ivlev LS. Aerosol impact at the climate processes. *Optics of the atmosphere and ocean.* 2011; 24: 392-410.
 50. Avakyan SV, Yevlashin LS, Kovalenok VV, Lazarev AI, Titov VG. The observations of aurora from space. L.: *Gidrometeoizdat.* 1991: 229.
 51. Avakyan S. Collisions of Rydberg-excited neutrals in the ionosphere and microwave radiation *J. Optical Technol.* 2006; 73: 302-303.
 52. Avakyan SV, Baranova LA. How does the geocosmos control the biosphere? 1. Formation of associates in high diluted water biosolutions under the influence of the microwave flux from the ionosphere. 2. DNA, ionospheric microwaves and water. In *Books of Abstracts 12th Inter. School and Conf. "Problems of Geocosmos"*. Oct. 8-12, 2018. St. Petersburg, Russia. Eds. by VS Semenov, SV Apatenkov, et al., SPbSU. Saint Petersburg: VVM Publ. 2018; 135-136.
 53. Avakyan SV, Baranova LA. How does the geocosmos control the biosphere? 1. Associate formation in biosolutions of extremely low concentrations in the field of microwave radiation of the earth's ionosphere. 2. DNA, ionospheric microwave radiation and water In *Proceedings of the 12th Intern. Schools and conferences «Problems of geocosmos-2018»*, Peterhof, St. Petersburg State University, 8-12 Oct. 2018 St. Petersburg: VVM Publishing House. 2018: 284-295.
 54. Andreeva OA, Abramenko VI, Malashchuk VM. Asymmetry variations in the 24th cycle of solar activity. Proceedings of the XXV All-Russian annual scientific conference "Solar and solar-terrestrial physics". Eds. Stepanov AV, Nagovitsin YuA, 4-8 Oct. 2021, GAO RAS, Pulkovo. 2021: 35-38.
 55. Binhi VN. The principles of electromagnetic biophysics. Moscow: Fizmatlit. 2011: 592.
 56. Makeev VM. Stochastic resonance and its possible role at live nature. *Biophysics.* 1993; 38: 194-201.