THE EFFECTS OF INTERACTION OF COHERENT WATER SYSTEMS WITH LOW INTENSIVE ELECTROMAGNETIC RADIATION

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For last decades the important practical and theoretical achievements in research of physics of water have been received. The most essential contribution was given by discoveries of SPE-effect (resonant interaction low intensive electromagnetic radiation of the HFR-range with water and the water environments of an alive organism) and the theory of water created from a position of the quantum theory of a field by outstanding Italian scientist J. Preparata. Authors of discovery of SPE-effect have discovered in spectra of resonant interaction of area near to 50 GHz (the mm-wave) the peaks with very high good quality; on the basis of that they have made a conclusion that water - biphase system in which are available the «ice-like» formations surrounded with usual molecules of water. However at such interpretation there are not explained some positions, the most substantial of which is absence of similar spectra for the ice and very high good quality of the found out peaks. Such good quality is comparable to good quality of peaks of laser radiation, which can be created only by the coherent substance.

A presence in water of «coherent domains» was predicted by J. Preparata in his theory of water. He has shown that in «coherent domains» the cloud of quasi-free electrons, which can be excited easily at giving them the external energy which is not exceeding the energy gap, equal 0.26 эВ on each molecule of water, is formed. This energy is distributed on all coherent domain as a result it passes to excited state. As follows from literary dates, the radiation from a «coherent domains» is revealed in diapason of mm-waves. On the basis of these information the supposition is first done in the real work, that the peaks of resonance interaction, discovered in spectrums got on the method of SPE-effect, specify on the presence of a coherent constituent of water, - «coherent domains», predicted by the theory of J. Preparata, but not on the existence of «ice-like» structure, as authors of discovery of SPE-effect considered.

Introduction

The spontaneous radiation of photons by the separate excited atoms in rarefied systems occurs on an exponential law on the assumption of absence of interaction of atoms with each other.

However, if appears an interaction of atoms between itself and with an external electromagnetic field, the character of the radiation changes. R. Dike has theoretically shown [1], that probability of spontaneous radiation of the excited atom, located in the system from N of identical excited atoms, situating on the distance smaller, than the length of wave of radiation λ, increases, in contrast with single atom, in N times (effect of superradiation Dike).

It is known (theory Dike), that for the coherent macrosystems consisting from the identical particles (atoms, molecules), the parameters of passage of nuclear reactions and radiating processes can cardinally change, may be opened the phenomena which are not found out in not coherent macrosystems. These researches find very important practical applications. Theoretical researches are known, in which only with the position of the existing of effect of R. Dike, the possibility of realization of low-energy nuclear reactions is grounded.

Water concerns to those systems in which can be revealed the phenomena caused by effect Dike, as water can be in a coherent states. Especially it is typical for nanowater, for example, for water in carbon nanotubes at helium temperatures, for near-surface waters of alive organisms (interfacial-water), etc. Properties of these water systems cardinally differ from properties of usual volumetric water.

The interaction of low intensive electromagnetic radiation of HFR-diapason with water

For last decades a significant progress in research of properties of usual water is carried out. The effect of resonant interaction of low intensive electromagnetic radiation (capacity of radiation ~ 1 мкВт/sm^2) the HFR-diapason with water and water environments of an alive organism (SPE-effect) [2] has been found out. Besides on the basis of postulates of the quantum theory of field, the theory of a structure of water [3] has been created by outstanding Italian physicist J. Preparata. As shown in [2-3], and also in numerous other works, water under usual conditions is not a homogeneous environment, it is the biphasic system.

The spectral curves received at research of effect of resonant radiation, the author of [2] in details has analyzed. He has paid attention to that fact, that both for usual water, and for the water environment of alive organisms the very narrow resonant peaks are found out at frequencies near to 50 GHz. Good quality of these peaks is the same, as well as for laser radiation; in addition, good quality of peaks for the spectrums of water environments of alive systems was in three times higher, than for ordinary water.

In the author of [2] opinion, the spectral dependences found out in the HFR-diapason indicate that in water the certain structural elements which has defined as "ice-like" elements of water are found out. These elements are surrounded by the ordinary molecules of waters. Thus, as the author of [2] considers, water in the ordinary state is not the homogeneous system, but is mixture of two states, - steam and solid phase.

Thus a solid phase is the crystalline "ice-like" formations floating among the molecules of waters, having a hexagonal structure, in which, as well as in the crystals of ice, the vibrations are possible in transversal and longitudinal directions.

According to this treatment, the peak on frequency 50.3 GHz corresponds to longitudinal vibrations "ice-like" structures, and to peak on

frequency of 51.8 GHz corresponds to transversal vibrations.

At such approach some details do not find explanation.

1. Uncertainly, which one the constituents of "ice-like" structures oscillate in transversal and longitudinal direction. Even, if these constituents are the separate molecules of hexagonal structures, instead of separate hexagonal planes or hexagonal rings, why frequencies of these vibrations have such high values and are found out in the of HFR- range?

2. Why corresponding spectrums are not found out in ice and diminish at freezing water?

3. Although the author of [2] links the high good quality discovered in the spectrums of resonance interaction of peaks with the high degree of synchronization of «ice-like» structures (especially in living organisms), he does not pull out supposition that these structures can appear coherent and to exist as single whole.

Theory of the prominent Italian theorist J. Preparata, for the first time applying the postulates of quantum theory of the field, most satisfactorily describes properties of usual volumetric water. Appeared, with a position of this theory, that usual water consists from two fractions - not coherent and coherent ("coherent domains") which simultaneously coexist, but in usual water at room temperature are in "flickering" regime.

Existence of coherent constituent of water also directly follows from the analysis of the spectral curves of spectrum of resonant interaction of water with low intensive electromagnetic radiation of the HFR-range (millimetric waves) (Fig. 1) in which the very narrow peaks are shown, with high good quality, typical for laser radiation.
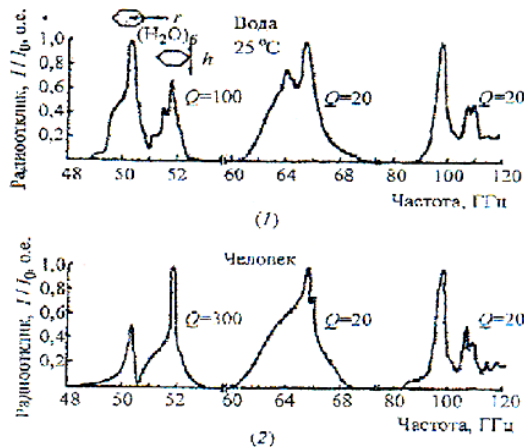

Fig. 1. Resonant spectra of water (1) and of tissues of an organism (2) [2]

The J. Preparata's theory in application to water systems

The condensation of a matter from ensemble of not coherent molecules of gas with a position of the quantum field theory can be connected to electromagnetic interaction of these molecules with a virtual photon [3] which, having fluctuated from vacuum, can transfer a molecule from the ground state in excited.

Let's assume, that in volume $V = \lambda^3$ contains N atoms or molecules with two possible states - the basic and excited; P - probability of that the photon, fluctuated from vacuum, can be the captured by atom or a molecule and will transfer it in the excited state. Then the full probability of capture of a photon is given by the following expression:

$$P_{tot} = PN = P\frac{N}{V}V = P\left(\frac{N}{V}\right)\lambda^3 = Pd\lambda^3. \quad (1)$$

If the density of atoms (molecules) in volume will exceed the certain size d_{crit} (at which $P_{crit} = 1$), the virtual photon never can return to vacuum.

This condition gives rise to transition of system from the disorder initial state in which quantum fluctuations are not synchronized and there is no tuning by an existing electromagnetic field, to a coherent initial state in which atoms lose the individuality, becoming a part of uniform ensemble: an electromagnetic field + the entangling material system.

Evolution of system into a coherent state is described by system of the dynamic equations received J. Preparata with a position of the quantum field theory for the two-level system described by a material field $\chi_l(x,t)$ with $l = 0, k$, and the electric field described in vector potential $A(x,t)$:

$$i\chi_0(\tau) = g\chi_k(\tau)A^*(\tau),$$
$$i\chi_k(\tau) = g\chi_o(\tau)A(\tau), \quad (2)$$
$$-\frac{1}{2}\ddot{A}(\tau) + i\dot{A}(\tau) - \mu A(\tau) = g\chi_o^*(\tau).$$

Where:

$$g = eJ\left(\frac{8\pi}{3}\right)^{\frac{1}{2}}\left(\frac{N}{2V\omega_k^3}\right)^{\frac{1}{2}},$$
$$\mu = \frac{e^2\lambda}{\omega_k^2}\left(\frac{N}{V}\right)$$

A - the directed average vector potential and $\tau = \omega_k t$.

The decision of these equations in application to water systems has allowed the author [3] to receive the following results.

At ordinary conditions, water is the two-phase system and includes the areas of coherency - «coherent domains» (CD), surrounded by the ordinary molecules of water. The sizes of «coherent domains» can be estimated as follows.

As the molecule of water has some levels, that level for which the threshold of density d_{crit} is most low has been chosen. The chosen level appeared the 5d state at 12.06 eV, just below the ionization threshold at 12.60 eV. Consequently the size of the «coherent domains» is the wavelength of the e.m. mode of 12.06 eV, namely 0.1 microns.

Thermal oscillation in usual water of both fractions lead to that: coherent and not coherent fractions coexist in a non-stationary regime (flickering regime). However the situation varies at transition to two-dimensional and one-dimensional water systems, where water is protected by a surface from destroying thermal influence. In such water the «coherent domains» can have essentially big sizes and exist for a long time (hours and days). The coherent environment in «coherent domains» is separated from not coherent component by an energy barrier.

The coherent state is the superposition of the ground state with a weight of 0.87 and the excited state with a weight of 0.13; this means that in the CD there are 0.13 almost free electrons per molecule.

The occurrence of coherent vibrations gives rise to occurrence of quasi-free electrons in a coherent state; therefore the «coherent domains» becomes a reservoir, which is easily excitable. Each excitation corresponds to a coherent cold vortex of quasi-free electrons. Excitation, which does not exceed the energy gap, cannot be received by an individual molecule, but belongs to the «coherent domains», as to single whole, giving rise to the collective excited state which also coherently. The huge quantity of the coherent states, characterized by angular moment L is found out. The spectrum of the excited states is limited from above by the energy gap, which is 0.26 eV per molecule.

Angular moment L is a quantum value and a certain frequency of the field corresponds to it.

$$\nu = \frac{L}{2\pi I} = L\frac{1}{2\pi I} = L\nu_{fundametal} \qquad (3)$$

Calculations show that $\nu_{fundametal}$ lies in the range 0.5-2.5 GHz, namely in the microwave interval.

Authors [4] specify that "The spectrum of the water CD is extremely rich; the spacing among levels is in the order of radio-waves (mm-waves) and the upper limit is extremely high".

Thus it is possible to make the assumption that the nature of resonant spectrums in HFR-range is connected with the energy transitions between the excited states of CD.

In them a crystal-like structure of CD, caused by presence for them the hydrogen bindings predicted by theory of J. Preparata, is shown.

Conclusion

Thus, in spectra of HFR-resonant interaction of electromagnetic waves with usual water is shown not the «ice-like» phase of water, but a coherent constituent of water system – «coherent domains». Presence in these spectra of two basic peaks specifies that coherent domains have a quasi-crystal structure.

References

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REACTION CROSS-SECTION CALCULATIONS FOR SOME DEUTERON INDUCED REACTIONS ON [89]Y

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There exist many parameters for determining the characteristics of a reaction and its possible outcomes, consequences and potential results. One of these parameters is the cross-section data. The information about cross-section data may help to the researchers on many topics like protecting from unexpected reaction results or saving money and time, concerning the experimental costs. Hence, there exist many studies focusing on nuclear reaction cross-section calculations. Likewise; in this study, theoretical calculations for some deuteron induced reactions on [89]Y fission reactor moderator material have been done. Obtained theoretical calculation results have been compared with each other and with experimental results taken from EXFOR database.

Introduction

Contentiously improving science and technology provide us many benefits and make our lives easier with respect to past. As it can be seen on the mankind's great scientific journey from the beginning of time to the current situation, energy has always a key importance and draws a special attention on itself. With the increasing population of our world and modern city life desire, cities become more and more populated and industrialized which results the desire of uninterrupted, stable, sustainable and more environmental friendly energy sources. Conventional energy production methods, which are getting better in many ways like environment and efficiency with respect to time, and alternative energy production ways, which are being more popular since a few decades but not so efficient, are not enough to satisfy the day by day increasing power demand. This issue causes the nuclear power plants come forward. With the help of fission principle, where a great amount of energy has outcome with respect to the same amount of any conventional energy production fuel, the mankind has a chance to produce more stable and uninterrupted energy. In