The study of influence of the Teslar ® technology on aqueous solution of some biomolecules

E. Andreev[1] *and V. Krasnoholovets*[2] *and G. Dovbeshko*[1]

[1]Institute of Physics, National Academy of Sciences, Prospekt Nauky 46, UA-03028 Kyiv, Ukraine
[2]Institute for Basic Research, 90 East Winds Court, Palm Harbor, FL 34683, U.S.A.

Abstract. The possibility of recording physical changes in aqueos solutions caused by a unique field generated by the Teslar chip (TC) inside a quartz wristwatch was studied using holographic interferometry. It has been shown that the refraction index of degassed pure distilled water and aqueous solutions of L-tyrosine and b-alanine affected by the TC does not change during the first 10 minutes of influence. In contrast, a 1% aqueous solution of plasma extracted from the blood of a patient with heart-vascular disease has showed changes in the refractive index of plasma solution affected by the TC. The characteristic time of reaction is about 10^2 s. Based on our prior research experience we state that the response of the system studied to the TC's field is similar to that stipulated by the action of a non-homogeneous constant magnetic field with the magnetic intensity of 11 Gs.

Key words: Teslar Chip, holographic interferometer, reflective index, amino acid aqueous solution, blood plasma solution.

1. INTRODUCTION

Numerous experiments fix the influence of electromagnetic field of certain frequency-amplitude ranges on living organisms (human and animals). For instance, the magnetic field with frequencies in the range 0.3 to 30 Hz and with the intensity that is comparable with the Earth magnetic field can effectively influence the living organism function. It is supposed that the mechanism of influence should be connected with the parametric, or Schumann Resonance. The first four harmonics of the Schumann resonance are known: 7.8 Hz ±1.5 Hz, 14.5, 20, 26 Hz (± 0.3 Hz) [1-3]. Well-known are two main mechanisms of the resonance reaction of the organism to a weak electromagnetic field. The first one is the Alfa-rhythm concerned with the thought process; the second one, the parametric resonance of organs, or organ systems, could be responsible for primary human reception [4-6].

A number of physiological processes, such as the reductive-oxidative process in living cells, responsible for the oxygen input, oxygen transport, etc. could be taken into account in this case. The parametric resonance of biological tissue and surrounding medium could be also responsible for the medical action of the TC.

The aim of the present study is: 1) the influence of the TC on a biological model system and 2) registration of this influence in those cases when it is possible. The inventors [7] of this device state that the chip produces a longitudinal scalar wave/field (the notation was introduced by Nicola Tesla [8]).

In accordance with the Tesla idea, the TC generates two in-phase electromagnetic fields of the first harmonics of Schumann resonance, which with the use of a special module are summarized in the counter-phase. In this case a part of the energy is radiated in the form of a 'zero-point' longitudinal wave (also known as a Tesla free-standing wave, a zero-point scalar waveform). In more detail, this wave has been studied in Ref. [9].

How to choose the method of the registration of this field? A model object must be sensitive; namely, it has to have a large gain factor and the method must be reproducible and stable, simultaneously. Since our goal is to account for biophysical aspects of the influence of the TC on living organisms, the model system should include components available in hypodermic tissues of the wrist. These conditions allowed us to choose, as the model of primary reception, the following:

- saturated aqueous solution of amino acids (tyrosine, tryptophane and alanine);
- diluted aqueous solution of human blood plasma.

The parameter under study has become the refraction index of an aqueous solution.

2. MATERIALS AND METHOD

Holographic experiments have been carried out with the use of the holographic interferometer IGD-3, developed and produced in the Institute of Physics of Semiconductors of National Academy of Sciences of Ukraine [10], whose optical scheme is given and described in Figure 1. The He-Ne laser (1) radiation (power output equals 1 mW at λ = 632.8 nm) is divided by the beam splitter cube (2) into two beams: the object beam and the reference beam. In the object beam shoulder there is the mirror (3) and the collimator (4) consisting of negative and positive lenses, which forms a parallel beam, 5 cm in diameter. The beam passes through the object under study (6), and then arrives at the finely dispersed diffuse scatterer (9). According to Lambert's law, its every point is scattering the light in all directions. Therefore, the light from the whole surface of the scatterer arrives at every point of the light sensitive thermoplastic (10). In the thermoplastic plane the object can be selected. Thus, at one inclination of the plate (5) the increase of the refraction index will result in the increase of the interference period, i.e. in the decrease of the number of bands. At another inclination (with the same sign of n, see below) it leads to lessening of the interference period and crowding of bands, i.e. to the increase of their number. In our case, the number of interference bands outside the flask field has remained unchanged and served for independent test over the object's alterations.

If the dielectric characteristics of the object studied are the same before and after the TC influence, the fringe pattern remains unaltered and interference bands inside and outside the object's profile continue each other. On the contrary, if an external factor caused changes of the refraction index of the object, the fringe pattern within the limits of the object's profile will change (especially the number of lines and the distance between them). In general, the best way is to follow the number of interference bands that move or pass through any point of the aqueous solution in a cuvette.

Teslar chip (7) has been put onto the top of a quartz cuvette ($1 \times 1 \times 4.\ 3$ cm^3) filled with the solution studied.

The amino acids used in our experiments were produced by Sigma, Inc. Aqueous solutions were prepared on the basis of pure bidistilled water. Prepared solutions, before the experiment, were maintained for 24 hours under 25 ^{o}C. The plasma blood solution was extracted from the blood of a heart vascular disorder patient just after the blood was drawn at hospital by conventional methods. We dilute the solution by distilled water as 1: 50 and 1: 100. The time between the blood extraction and the holographic measurement was about 4 hours.

The procedure of dynamic measurement consisted of a sequence of records of interference patterns on a special thermoplastic plate, which then was fixed by a digital video camera. Afterward, the images were input into the computer and evaluated. For determination of the interference band centre, the 10 points along the horizontal line of cuvette have been chosen.

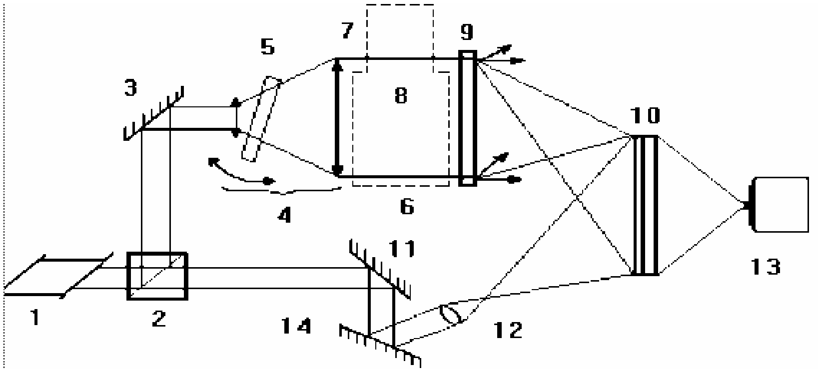


Figure 1. Experimental holographic set. 1 – He-Ne laser; 2 – beam splitter cube; 3 – mirror; 4 – collimator; 5 – plane-parallel plate; 6 – quartz flask (cuvette) with the solution; 7 – Teslar bracelet; 8 – filter that divides two flasks; 9 – scattering layer; 10 – thermoplastic recording plate; 11 – reference beam mirror; 12 – reference beam lens; 13 – TV camera.

The studies were conducted at temperature $20^{\circ} \pm 1.5$ °C controlled by the thermocouple accurate to 0.2° C. We suppose that absolute meaning of the temperature does not influence the process under study due to the fact that we have been recording a dynamics of redistribution of the optical density. The most important point in the experiment was to protect the cuvette from the temperature gradient and the airflow. The last two disturbed factors have determined an inner non-stability of the system.

In Figure 2a, typical interference patterns of the aerial ambient space ("Air") and the aqueous solution ("Solution") are presented. Vertical black lines show the image of the cuvette corner (its size $1 \times 1 \times 4$ cm^3). Thus in our experiments we have been able to observe an alteration of the reflective index in the surface zone of the cuvette equal to 1×2 cm^2 that is determined by the cuvette size and the aperture of laser beam.

Deformations of the interference pattern in different points of the solution have been caused by changes in the refractive index in these points. The resolution has been defined by a location of the optical wedge, namely, by a sum of horizontal interference lines. In our case the space resolution was about 2 mm.

The method described gives a possibility to follow the response of the solution with the time factor of minimal discontinuous ability equal to 10 s (i.e. there is a delay in the actuation of the method equal to 10 s). A sequence of pictures of the fringe pattern characterizes the space dynamics of the system studied in any place of the cuvette that we wish to investigate. As an example, Figure 2b shows the fringe pattern formed in 3 minutes 45 seconds starting from the moment of action of the TC. The system reaches a satisfactory stability in 5 minutes. This means that changes of interference bands, which occur during the 5-minute interval, should be associated with the action of an internal stimulus.

The TC was put on a nonmagnetic rod near the cuvette, 5 cm apart from the sidewall, 1 hour before the start of the measurement. It was done to smooth the temperature of the TC with the ambient temperature. In the course of the experiment, the TC was spaced at 2 mm from the cuvette.

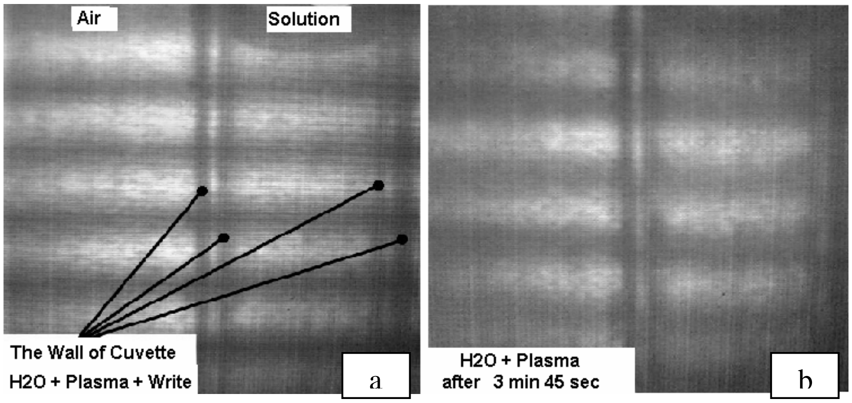


Figure 2. Dynamics of the fringe pattern of the aqueous solution of plasma blood of human without the influence of the TC. The value of the effect is estimated by difference between the shift of the interference band in the cuvette with the solution and the position of same band in the air; we evaluated the shift of interference bands before and after the TC application. It is seen that during 4 minutes the bands in the cuvette have not been deformed and they have essentially not moved relative to those in the air.

3. RESULTS AND DISCUSSION

A primary series of the experiments was conducted with distilled water, the saturated aqueous solution of L-tyrosine and β-alanine at 25 °C. The experiments were conducted both in the morning and afternoon. The results showed typical slight changes of the fringe pattern in 400 s or larger time interval. These changes should be associated with the inner drift of liquid parameters. The curve of long-time dynamics does not show any influence on the side of the TC approximate to the cuvette.

The other behavior and picture have been observed in the case of the blood plasma solution. Without the TC action this solution has shown stable and reproducible characteristics during more than 4 hours.

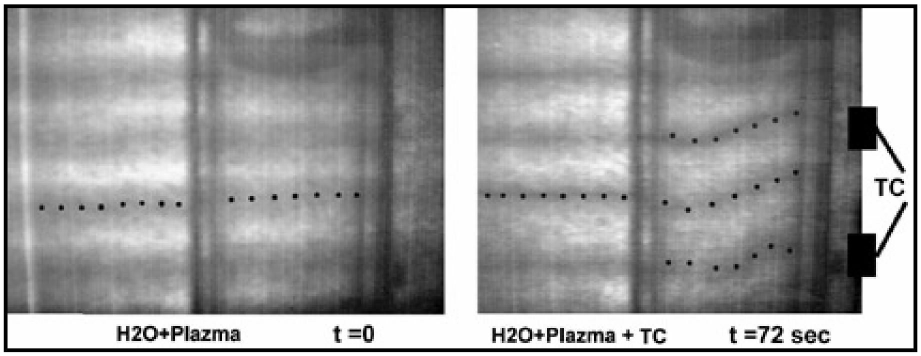


Figure 3. Dynamics of the fringe pattern of the aqueous solution of plasma of human blood after the insertion of 2 TC. The strong disturbance of the optical density of the solution is emerged already in 72 s, right figure. (The back covers of two sections of the bracelet are found at 4 mm from the right wall of the cuvette).

During more than one hour the system of recording and the objects of study (the solution of plasma and water) were stable and reproducible.

In Figure 3 we present the image of the cuvette with plasma blood solution affected by the TC. Black dots indicate the center position of one of the interference bands on the image plane. The value of the shift relating to zero line characterizes the degree of influence of the TC. Black rectangles (Figure 3, right) show the positions of two Teslar chips relating to cuvette. The fringe pattern (Figure 3, right) of the solution relating to the chip is deformed in different ways in different zones (short, mid, and far-distance). A physical mechanism of the change seems to be associated with the increase of the reflective index in the short-distance zone; the reflective index remains unchanged in the mid-distance zone and decreases in the far-distance zone.

Moreover, it seems that slow laminar flows have been induced by the TC near the front wall, which have been directed just to this wall.

3.1. Primary data

Primary data of the holographic interferometer constitute the two-dimensional interference pattern and the shadow of the quartz cuvette filled with the solution studied. Each section of the graph gives information about a relative change of the length of optical path of the laser beam when it passes through the object under study. If the refraction index of the solution changes in one place under the influence of an external factor, the length of optical path will also change. For its part, this revises conditions of interference in the recording thermoplastic and alters the fringe pattern. With the purpose of the registration of the changes, the device is designed in such a way that the "starting interferogram" constitutes a family of horizontal bands, bands of equal thickness. Depending on the character of changes of the optical density in the cuvette volume, the bands can be distorted (local changes of the refraction index), gaps between bands can expand without deformations (volumetric decreases of the refraction index) and gaps between bands can converge without deformations (volumetric increases of the refraction index). Thus arbitrary deformations of the fringe pattern are caused by a combination of local and global changes of the optical density.

3.2. Possible physical reasons of changes of optical density

Hereafter we imply that changes of the refractive index are produced by changes in the structure of the network of hydrogen bonds of water, which being under the influence of oxygen, biomolecules and an external field, forms long-lived structures. In the mentioned network those new structures try to minimize the total energy relative to the volume occupied by the water system. Such kinds of changes (structuring of the aqueous solution) occur sufficiently slowly and therefore can be recorded by optical methods.

3.3. Characteristics of the objects studied

Bidistilled water was produced by typical equipment that bonded volatile organic admixtures. Water was preserved for one month in a special closed glass vessel. Solutions of amino acids and protein were prepared immediately before the experiments. Refined fresh plasma of human blood was prepared at hospital.

3.4. Results

The strongest changes in the TC effect have been detected during the first 5 to 15 minutes starting from the moment of influence. The changes in the fringe pattern have been irregular in time. The largest changes occurred during the first 5 minutes, which then became weaker. Within the first 5 minutes the increase ranged up to half the interference band; within 10 minutes it ranged up to one and a half the band. Since that moment, the picture stopped changing. The latter fact allows the assumption of the saturation effect. Without the influence of the TC the number of interference bands remains the same in the field of the object and around it and is equal to five (it is the most proper situation for the observation of the bands on screen). In 15 minutes for the solution without the influence of the TC, only half band changes were observed. Since these changes were observed in the whole volume, their nature was regarded as a macroscopic one. Changes in the refractive index of the sample affected by the TC estimated from equation

$$L\Delta n = \lambda \Delta k$$

where L is the thickness of the sample (the aqueous solution studied), Δn is the change in refractive index, λ is the wavelength of the source of light (laser), Δk is the change in the number of interference bands as a result of an external effect.

The experiments have shown that the 5-minute influence of the TC on the aqueous solution leads only to minor changes of the fringe pattern, though the 15-minute exposure has changed the number of interference bands by one. Thus, weak effects also occurred in water, though their contribution is small ($\Delta n = 2\times10^{-5}$). These preliminary results suggest that the behavior of proteins is mainly determined by the influence of the TC. Effects associated with the TC and heating effects have shown the opposite trend / tendency. The temperature rise in the flask detected by the thermo sensor with 1 mW/cm^2 power density ranged between 0.2 to 0.5 K. Therefore, heating caused by the laser radiation allows an evaluation of the role of temperature effect. The estimation of the temperature effect by using the thermal conductivity equation and the thermal balance equations show the following. The maximum heating of the aqueous solution without account of the thermal exchange, i.e. under the condition unfavorable for the thermal effect estimation, may amount to 1 K. The calculation shows that even without the heat exchange between the aqueous solution and the environment the radiation effect with the power density of 10 mW/cm^2 may produce an increase of 1 K of the temperature of the 1.5-cm^3 volume of aqueous solution within 6 minutes. A lower temperature value (0.2 to 0.5 K) has been obtained by measurements using the thermo sensor. The temperature coefficient of changes in the refraction index of water makes up 6 × 10^{-5} K.

In our experiments with the TC, the maximum change of the refraction index of the protein solution reached the value of n = (3 to 4) × 10^{-4}, which is an order of magnitude larger than the temperature changes of the refraction index. Thus the numerical estimates and the experimental data show that changes of the refraction index caused by the influence of the TC have been conditioned by non-thermal changes of the solution dielectric constant, which may be described as the total contribution of electronic, vibration and orientational components.

By using the holographic interferometer we could visualize and study the influence of the TC upon biological aqueous solutions; however more experiments and their repeatability are needed.

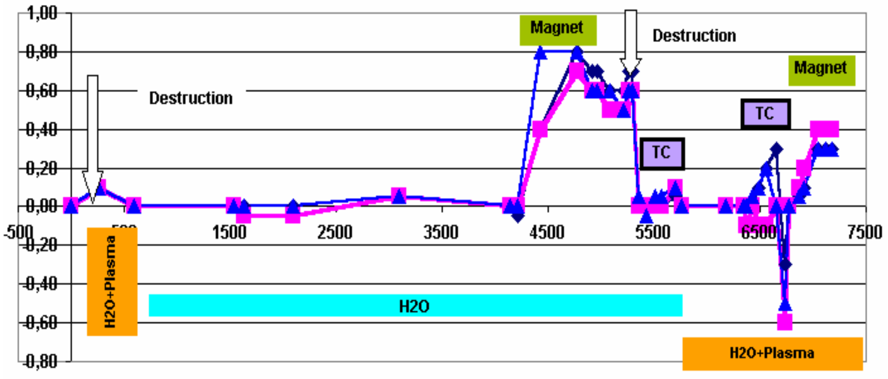


Figure 4. Dynamics of changes of the fringe pattern of the cuvette's volume at different external factors.

In Figure 4, experimental dots show changes of the refractive index of the solution [the vertical axis] at the cuvette's back wall against the upper TC (rectangles) and the lower TC (triangles); recall the two TC are located near the front wall (see Figure 3). Current time, in seconds, is plotted along the horizontal axis. Legends "H2O" (the blue background) and "H2O + Plasma" (the orange background) indicate different solutions in the cuvette. Time intervals are singled out for the following cases: 1) the magnet ("Magnet" on the green background) is applied to the front wall of the cuvette and 2) two links of the bracelet with two TC are set into the cuvette (the violet background). Moments of intermix of the solution ("Destruction") are shown by means of arrows; the intermix was made by using a medical syringe with 0.2 mm-needle. The solution was absorbed from the cuvette by the syringe and then poured back.

The insertion of the magnetic field induced a response on the side of pure distillated water in the cuvette, because the water had dissolved oxygen (oxygen is a strong paramagnetic). After the destruction described above, we inserted the two links of bracelet with two TC in the system studied (see Figure 3). However, the availability of two TC does not produce any response on the side of water. Then the same experiment was carried out on the solution of plasma. In this case TC gives rise to a response on the side of the solution. Deformations of the fringe pattern indicate that the refraction index decreases on the opposite wall of the cuvette. If in this case we replace the two TC by the magnet, deformations of the fringe pattern become opposite, which means that the refraction index increases.

Changes in the aqueous solutions cover the entire macroscopic volume; the system affected by the TC replied as a whole. This can be associated with both inner convective flows (as with Benar cells) and structural changes of water. Under the water structure we mean the space architecture of domains arising under a spontaneous separation of the liquid and the redistribution of hydrogen bonds. The latter could lead to changes in both the reflective index of the solution and the fringe pattern.

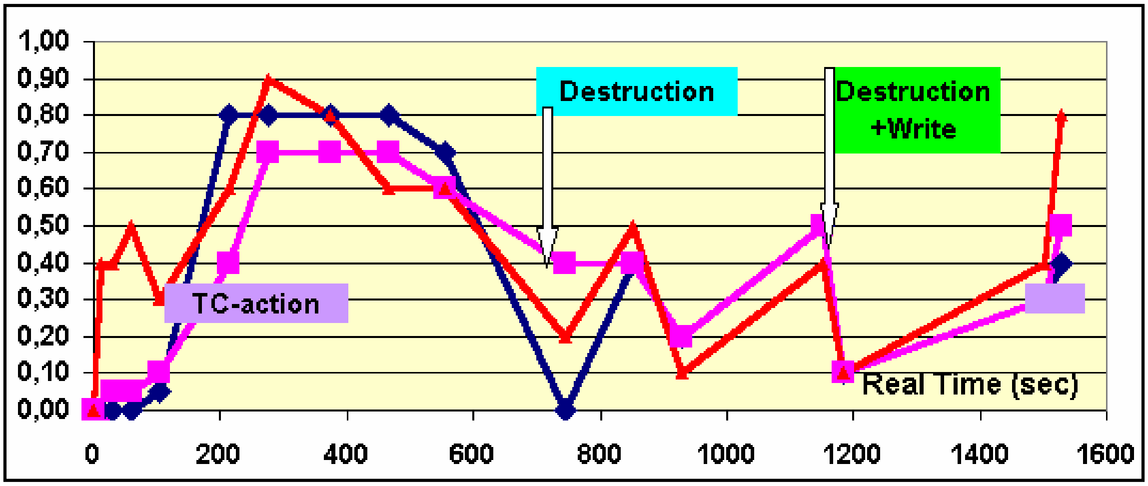


Figure 5. Chart shows more detailed dynamics of the solution of plasma in the upper part of the cuvette (just against the upper TC) near the back wall [rectangles], in the center of the cuvette [triangles] and near the front wall of the cuvette [black rhombus].

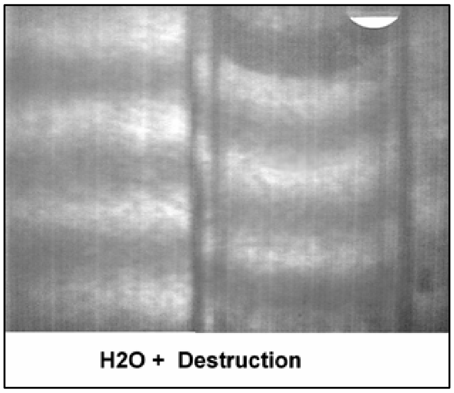
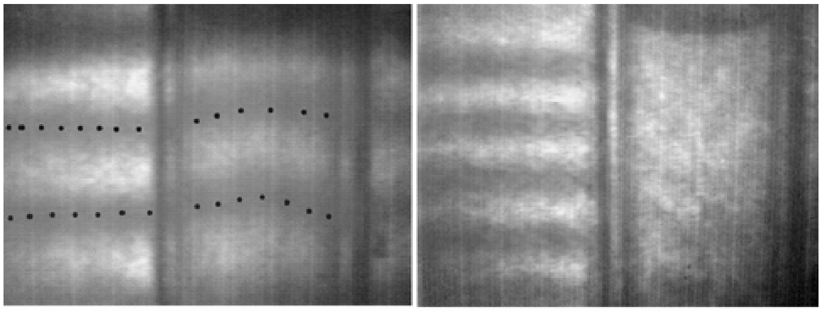


Figure 6. The fringe pattern of the cuvette with distilled water after an intensive mechanical action (a turbulent stir of the liquid by a syringe with a thin needle).

A specific feature of the TC's influence consists in the fact that the TC effect is still preserved after removing the TC (the memory effect that is characteristic of different water systems). In Figures 6 and 7 one can see fringe patterns of water and the aqueous solution, respectively, after their destruction. Here, the destruction means a mechanical stir of the liquid sample with syringe. This procedure signifies the extraction of a portion of the liquid sample from the cuvette and the subsequent filling of the cuvette again (without any gas bubble formation); the procedure was done twice.



H2O + Plasma + Destruction before TC Action

H2O + Plasma + Destruction after TC Action

Figure 7. Comparative picture of the plasma solution response to a turbulent stir with syringe depending on the prehistory of the sample. The left picture shows the response of the solution before the influence of the TC; the right picture is the same solution after the 15-minute irradiation by 2 TC.

In 15 minutes after the second filling of the cuvette, the fringe pattern was recorded. We have revealed that both distilled water (Figure 6) and the aqueous solution of plasma of blood (Figure 7) show very similar responses to this procedure. However, in the case of the aqueous solution of plasma previously affected by the TC, the solution is specified by the turbulent-like picture, Figure 7, right.

4. CONCLUSION

The results obtained make it possible to conclude the following: the Teslar chip does not affect both degassed (bi)distilled water and (bi)distilled water in equilibrium with the atmospheric air. However, some of the biomolecules of plasma of blood or an ensemble of such biomolecules in a micromolar concentration in water lead to the changes in reological characteristics, which allows the observation by optical methods and, in particular, by the holographic interferometer. Therefore, we can say that in the aqueous solution of blood plasma, biomolecules play a role of primary receptors of the TC radiation.

Changes in the aqueous solution cover all the macroscopic volume of the sample studied and this system affected by the Teslar chip responds as a whole. This behavior can be associated with both inner convective flows (like in the case of Benar cells) and structural changes of water. The latter may bring about changes in the reflective index of the solution and the fringe pattern.

Thus comparative responses of the aqueous solution to the mechanical, magnetic and Teslar chip influences point to a very specific action of the Teslar chip. Although a microscopic physical consideration of the phenomenon of Teslar chip's field has already been performed in some detail [9,13], a more extensive study and repeated examinations should be completed to shed more light upon the mechanism of action of the Teslar chip upon living organisms.

References

[1] W. R. Adey and A. F. Lawrence (eds.), *Nonlinear Electrodynamics in Biological Systems* (Plenum Press, New York,1984).

[2] V. V. Novikov and A.V. Karnaoukhov, Mechanism of action of week electromagnetic field on ionic currents in aqueous solution of amino acids, *Bioelectromagnetics* **18**, 25-27 (1997).

[3] P. P. Belyaev, S. V. Polyakov, E. N. Ermakova and S. V. Isaev, An experimental study of the Alfen ionospheric resonance by observation of electromagnetic noise in the sun cycle, *Izvestia VUZov* (*Radifizika)* **40**, 1305-1315 (1997); in Russian.

[4] N. A. Temuryanz, B. M. Vladimirsky and O.G. Tishkin, *Extremely low frequency electromagnetic signals in the biological world* (Naukova Dumka, Kyiv, 1992); in Russian.

[5] A. R. Liboff, Interaction between electromagnetic fields and cells, *NATO ASI. Series* **A 97**, p. 281 (Plenum Press, New York, 1985).

[6] G. A. Mikhailova, A possible biological mechanism of influence of solar activity on the central nervous system of human being, *Biofizika* **46,** no. 5, 922-926 (2001); in Russian.

[7] Extremely Low Frequency Laboratories, http://www.teslar.com.

[8] N. Tesla, *My Inventions: The Autobiography of Nikola Tesla*, Ben Johnston (Editor), Publisher: Hart Brothers (1981); ch. 6. (Also http://www.spaceandmotion.com/Physics-Nikola-Tesla-Inventions-Resonance.htm).

[9] V. Krasnoholovets, S. Skliarenko and O. Strokach, The study of the influence of physical fields of *Teslar*® technology on liquids in a critical range, *Final Report of the Project* (2004).

[10] G. S. Litvinov, N. Ya. Gridina, G. I. Dovbeshko, L. I. Berzhinsky and M. Ya. Lisitsa, Millimeter wave effect on blood plasma solution, *Electro- and Magnetobiology* **13**, no. 2, 167-174 (1994).

[11] G. Dovbeshko and L. Berezhinsky, The physical evidence of the weak electromagnetic field action upon biological systems, in: *Proceedings of 4th European Symposium on Electromagnetic Compatibility,* Sep. 11-15, Brugge. Vol. 2, pp. 41-46 (2000).

[12] L. I. Berezhinsky, N. Ya. Gridina, G. I. Dovbeshko and M. P. Lisitsa Visual observation of mm- wave action upon blood plasma, *Biophysics* **38**, no. 2, 378-384 (1993); in Russian.

[13] J.-L. Tane and V. Krasnoholovets, An Extended Interpretation of the Thermodynamic Theory Including an Additional Energy Associated with a Decrease in Mass, *International Journal of Simulation and Process Modelling*, submitted on 30 September, 2004.