ELECTROPHOTONIC ANALYSIS OF COMPLEX PARAMETERS OF THE ENVIRONMENT AND PSYCHO-EMOTIONAL STATE OF A PERSON

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Introduction

Ecological state of the environment and its influence on the health and well-being of people is determined by the total set of parameters bio and techno-sphere. These include features and climate of the area, in particular, the level of solarization, the level of air pollution, the distribution of the electromagnetic fields, both natural and anthropogenic origin, and many other factors. As shown in recent years, a significant contribution is made by such heterogeneity of the earth's crust structure as discontinuous zones of tectonic disturbances and tensions, in particular, ancient buried rivers[1,2] . In the period 1992-2005 in St. Petersburg, Russia, a large scientific team took a number of geological, geochemical, geographical and ecological surveys, correlating them with the health status of population. As a result, a statistically significant correlation between the level of disease in different areas of St. Petersburg and the presence of underground anomalies was demonstrated[3] . The influence of the electromagnetic field on the human health is widely discussed[4], including effects of electromagnetic radiation of artificial origin on the overall balance of the Earth's own microwave radiation and the response of biological systems to perturbations of the electromagnetic field in the high frequency (HF) and very high frequency (VHF) bands through human activities[5] . The variety of factors and their dynamic nature requires the use of complex specialized methods that is not always available, even for well-equipped research centers. This makes the evaluation of hazards difficult even for large companies, not to mention the individual citizens. Meanwhile, a similar assessment is fundamentally important both at the design phase of new construction, and in the analysis of the causes of poor health and increased incidence of people in certain climatic and geographical areas. Therefore, the actual challenge for engineering is to develop a low-cost device for informative comprehensive evaluation of the integral parameters of the ecological environment, which can be used both in a professional environment, and the civilian population.

EPI/GDV Technique

The Human Energy Field (HEF) is a highly sensitive reflection of the physical, emotional, and in some instances, the spiritual assessment of an individual. To measure this, data is obtained from the fingers of both hands and is converted into an HEF image using proprietary sophisticated software. This technology is predicated on the Gas Discharge Visualization (GDV) process. The results are interpreted based on the energy connection of fingers with different organs and systems via meridians that are used in acupuncture and traditional Chinese medicine. Application of computer technology in the processing of electrophysiological information can significantly accelerate obtaining research results, to standardize the procedure, as well as to reduce the influence of the subjective factor. Electrodiagnostic techniques such as Electro-encephalogram and Electro-cardiogram are widely used in medical practices worldwide[6]. A promising method already utilized in sixty-two countries to great success is bioelectrography, based on the Kirlian effect. This effect occurs when an object is placed on a glass plate and stimulated with current; a visible glow occurs, the gas discharge. With EPI/GDV (electro-photon imaging through gaseous discharge visualization) bioelectrography cameras, the Kirlian effect is quantifiable and reproducible for scientific research purposes. Images captured (BIO-grams) of all ten fingers on each human subject provide detailed information on the person's psycho-somatic and physiological state[7]. The EPI/GDV camera systems and their accompanying software are currently the most effective and reliable instruments in the field of bioelectrography[8,9,10,11,12]. EPI/GDV applications in other areas are being developed as well[13,14,15,16,17,18,19,20,21]

Through investigating the fluorescent fingertip images, which dynamically change with emotional and health states, one can identify areas of congestion or health in the whole system. Each generated fingertip photograph is analyzed by sector division, according to acupuncture meridians. Dr. Peter Mandel, in Germany[22], and Dr. Voll, over many decades, have developed this intricate and well-defined method of seeing into the entire body through the fingertips. EPI/GDV technique researchers created a diagnostic table based on years of their own clinical field-testing, the sector basis of which differs slightly from that of Dr Mandel[23].

The parameters of the image generated from photographing the finger surface under electrical stimulation creates a neurovascular reaction of the skin, influenced by the nervous-humoral status of all organs and systems. Due to this, the images captured on the EPI/GDV register an ever-changing range of states[24]. In addition, most healthy people's EPI/GDV readings vary only 8-10% over many years of measurements, indicating a high level of precision in this technique. A specialized software complex registers these readings into parameters which elucidate the person's state of wellbeing at that time[25].

Monitoring the Environment

The GDV device with a specially designed sensor called the "Sputnik antenna" is used to monitor the Energy of the Environment and its effects on emotional status. The "Sputnik antenna" is a specialized Bio-Well device that measures the energy of the environment in a room that enables you to see how it varies when people meditate, pray or listen to a presentation. The physical principle it is based on is measuring the electrical capacitance of a space by using two connected resonance contours.

Schematic representation of the experimental setup is shown in Figure 1.

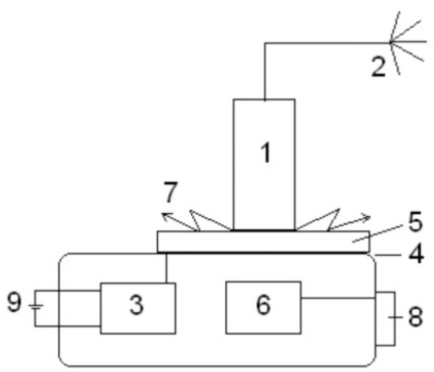


Fig. 1 The experimental setup. 1 - metal cylinder; 2 Antenna "GDV Sputnik"; 3 - high-voltage pulse generator; transparent conductive coating; 5 - transparent quartz electrode; 6 - video converter; 7 - gas discharge; 8 - USB-drive; 9 - Power Supply

Titanium cylinder 15 mm in diameter connected to an antenna 2 is positioned on the quartz surface of the electrode 5, the reverse side of which is covered with a transparent conductive coating 4; from the generator 3 every 5 seconds a voltage in the form of a pulse sequence of up to 7 kV amplitude, 10 microsecond duration at a frequency of 1 kHz is applied to the coating. Gas discharge 7 light is is transformed by optoelectronic system 6 in a series of images, which are analyzed in a computer. The outcome files have timestamps, which allows after processing to compare them with the sequence of registered events.

Experimental system in case of being in the room can be represented as an equivalent circuit of the connected LC circuits (see Fig. 2).

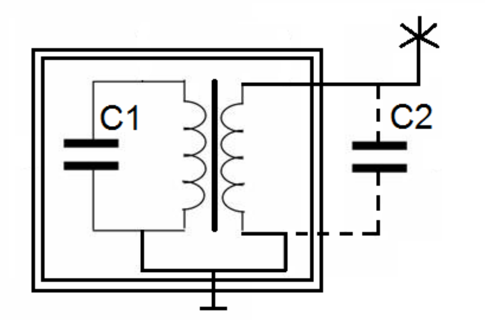


Fig. 2 Equivalent circuit diagram of the experimental setup, where C1 corresponds to the capacity of the electronic circuit of the GDV device, C2 - the equivalent capacitance of the antenna in the premises.

Discharge develops due to displacement currents between the antenna 2 and grounded or conductive objects in the environment. Depending on the availability of fields of different nature in the environment, the chemical composition of the air and the state of the conductive objects (which includes humans), conditions of electromagnetic wave propagation in space are changing, therefore the currents in the system are redistributed, thus influencing parameters of the glow. Thus, this experimental system can react to changes in the electrical capacitance of the space surrounding it and the presence of the conductive objects. Changes in the functional state of the human body leads to a change in the impedance of the body, the field distribution around the body, the chemical composition of the ambient air due to exhaled air and emissions of endocrine substances through the skin.

Data processing was carried out in a specially designed software (www.Bio-Well.com). For analysis both the absolute values of the GDV parameters and their standard deviations in the series were taken into consideration.

During the measurements the control of the environment parameters: relative humidity, temperature and pressure was undertaken. In some cases, available through the Internet geophysical parameters: phases of the moon, geomagnetic situation on the day of measurement and a number of other parameters were taken into account as well.

Sputnik sensor may be useful for the following purposes:

1. Testing different places in a search for locations that are calm or contain turbulent energy.
2. Testing the energy status of different sites that are significantly affected by the position of the sun, moon, season or time of the year, etc.
3. Measuring the energy in the Places of Power – both natural and man-made, such as temples and other houses of worship, sacred places, ancient cities, etc.
4. Testing Geoactive Zones, in particular, Geopathic Stress Zones[26].
5. Detecting the influence of emotions and focused attention on the environment.

It has long been observed that people feel differently depending on environmental factors that may include temperature, humidity, atmospheric pressure and geographic location. There are some places where you sleep like a baby, have wonderful dreams and wake up full of energy. But there are others where sleeping is disrupted, fatigue is frequent and there is increased susceptibility to illness. Western science has no explanation for this other than it represents a confluence of geomagnetic influences, subterranean anomalies, hollows, water streams, natural and industrial atmospheric gases; gases, electromagnetic fields, and especially solar and cosmic emanations. It has been practically impossible to distinguish between all these factors or to determine what each contributes, so our ability to measure the cumulative effect at any particular place can best be described as primitive and rudimentary.

The equivalent circuit of the device for registration of GDV-grams

To identify the optimal range of the instrument parameters dependence of the GDV parameters on the capacity of the connected capacitor in the range 8 - 220 pF was determined, as in the study of a variety of materials and GDV parameters are within the limits of this range. Below 8 pF the gas discharge was not formed or was unstable. An example of the experimental curve is shown in Fig. 3 Optimal sensitivity is observed on increasing part of the curve, the choice of which is due to both the circuit elements of the device, and the parameters of the environment.

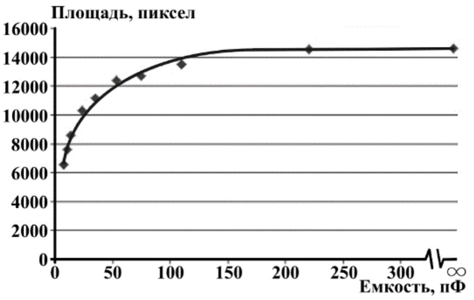


Figure 3. Dependence of the GDV image area on the capacitance.

The GDV device may provide an exciting breakthrough. Many years of research, including expeditions to Peru, Colombia, Ecuador, India, Myanmar, Siberia, and other locations have demonstrated the sensitivity of this device to assess local environmental conditions and idiosyncrasies. Sensor signal variations during sunrise and sunset or just prior to a thunderstorm were registered. Measurements conducted during religious ceremonies, yoga exercises, group meditation, public lectures, and musical performances also showed statistically significant changes in the signal of the Sensor during these activities that correlate with the duration of the event. Therefore, the signal of the sensor depends on complex environmental parameters, many of which are not directly measurable. We can say that the sensor "GDV Sputnik" (Figure 5) is an integral environment analyzer.

Figure 5 GDV "Bio-Well" device with "Sputnik" sensor.

Method of data processing

Figure 6 shows the image of the glow of the metal test object (BIO-gram).

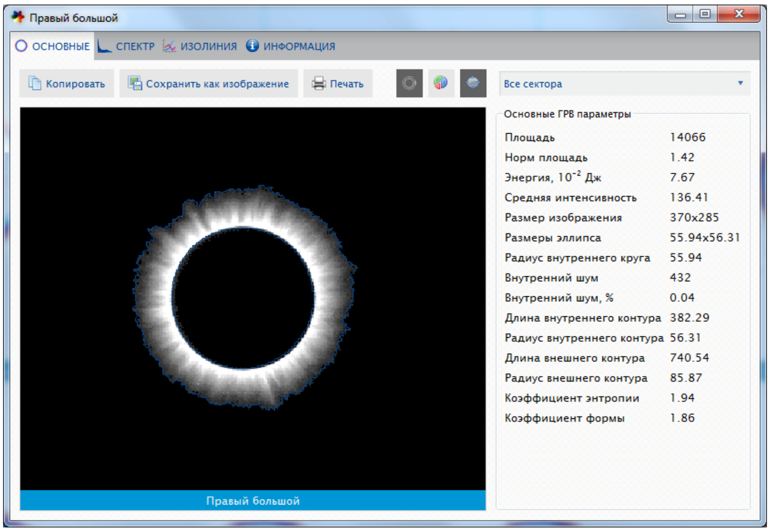


Figure 6. The screen of the "Bio-Well" software with images of the emission of the metal test object and a list of the main parameters.

It has been shown that the basic informative parameters for analysis are:

1 Area: the number of pixels of the image after program noise removal, proportional to the number of photons forming the image at a given time.

2 Intensity: The average intensity of the radiation.

3 Energy: the energy level of the radiation.

4 Standard deviation of parameters estimated in the mode of the sliding window.

The radiation energy is calculated as the product of the intensity of the glow area, with the experimentally determined coefficient depending on the sensitivity of the CCD device. Coefficient is calculated based on the following data.

As shown in[27] , the sensitivity of the CCD is determined by the following expression:

$$\frac{1}{S} = \frac{W}{I} = \frac{E}{s \times I} = \frac{4P \times t \times T}{\pi \times d^2 \times I},$$

where W - the energy density of the radiation source [J/cm^2], I - magnitude of the response (signal), E - energy of the radiation source [J], s - illuminated area of the CCD [cm^2], P - Power of radiation source [W], t - shutter speed set of the camera [s], T - total transmittance of filters used in the detection of radiation, d - diameter of the illuminated area of the CCD [cm].

Experimentally it has been determined that the sensitivity decreases with increasing wavelength and for $\lambda = 424$ nm is of the order 10^{-10} J/cm^2.

Naturally, this parameter also depends on the type of the CCD and the optical path used. Therefore, an experimental evaluation of the GDV devices CCD camera parameters using incandescent bulbs with known parameters was done. Calibrated 10W lamp with relatively uniform flow of radiation in the visible range was used. For this lamp illumination corresponded to the area S = 61000 pixels at a spectrum range from 55 to 255 with maximum of 160 and an average of 220. Hence, the equivalent power source can be calculated as:

P (W) = Pcalibr*S*I/(S*I)calibr = S*I*10 /61000*220= S*I*8*10^{-7}

Energy E (J) = P (W) * t (seconds)

GDV impulses has 10^{-4} s duration with a frequency of 1000 Hz applied for 0.5 s. Consequently, the signal acquisition time on the CCD matrix is 5 * 10^{-2} s, from where E = 5 * 10^{-2} P Thus, the formula for the energy of the radiation GDV signal takes the form

$$E\ (J) = S*I*4*10^{-8}$$

With this formula, both the results of BIO-grams processing and dynamic data can be represented in terms of the radiation energy.

Studies have shown that not only the absolute values of the parameters are informative, but also their variability over time. The absolute values of the parameters are associated both with different physical and chemical characteristics of the environment and the presence of conducting and polarizable objects in close proximity (within a few meters) of the antenna, since these characteristics determine the capacitance between the antenna and the "ground". Standard deviation of "area" and "energy" is associated with the stability of these parameters over time. Therefore, we proposed a method of calculating of the GDV parameters variability.

Because of the nature of research it is necessary to determine the standard deviation (SD) not for the whole sample (for all the measurements time), but the change in standard deviation over time. Accordingly, the method of calculation in sliding window mode was chosen, ie, each SD value was calculated based on a certain number of previous values of the GDV parameter. The key issue was to determine the number of values, which are calculated on the basis of standard deviation. On the basis of experimental data base interval to calculate standard deviation have been identified - a half to two minutes, that is with a 5-second interval between each digit it ranges from 18 to 24 values of parameters. In order to standardize procedures for data processing the size of the sliding window was chosen to be 20 digits. Consequently, the following formula for SD calculating was accepted:

$$\sigma_t = \sqrt{\frac{1}{20} \times \sum_{i=t-19}^{t} (x_i - \bar{x})^2}$$

where t - sampling unit from which counting the 20 latest GDV parameters starts; x_i - i-th element of a sample of 20 values; $\bar{x}$ the arithmetic mean value of the parameter.

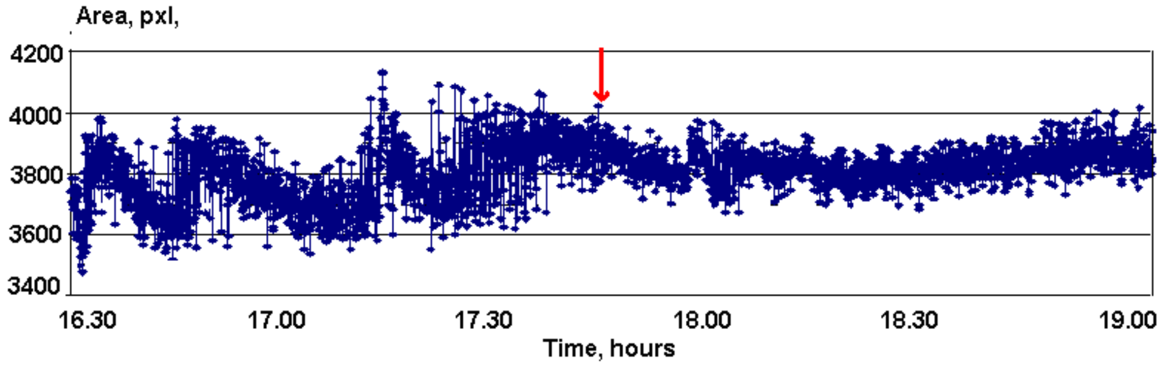
With an increase of the sliding window the sensitivity of SD index is lost, while with a decrease - the noise level increases, as the weight of a single value becomes too large.

The software allows to perform automatically statistical analysis of a time series data. The program calculates the mean and standard deviation for each interval and statistical comparisons of adjacent intervals by the method of Student's t and Mann-Whitney tests. All input data are stored in a file for further processing in the statistical programs.

Studies have shown that in indoor environment parameters of the sensor reached the steady-state level after 15-45 minutes of operation, after which the variability of a signal for 5-6 hours was not statistically significant and did not exceed 10%. Significant changes in the signal were recorded when the relative humidity changes more than 5% and the temperature jumps to +/- 5 ° C.

Results

A large series of studies and field trials in Russia, Venezuela, Colombia, England, in the period 2008-2014 showed that the instrument is sensitive to changes in environmental parameters. For example, in August 1, 2008, a series of measurements in Novosibirsk, Berdsk, Irkutsk and Abakan using 7 independent GDV devices during a total solar eclipse was conducted. All experimental curves had two distinct phases: before and after the eclipse (Figure 7). Before the eclipse in all graphs long-wave oscillations of two types were observed: decreasing (for two devices) and increasing (for five devices). After the eclipse signal has stabilized with the variability of less than 1%.



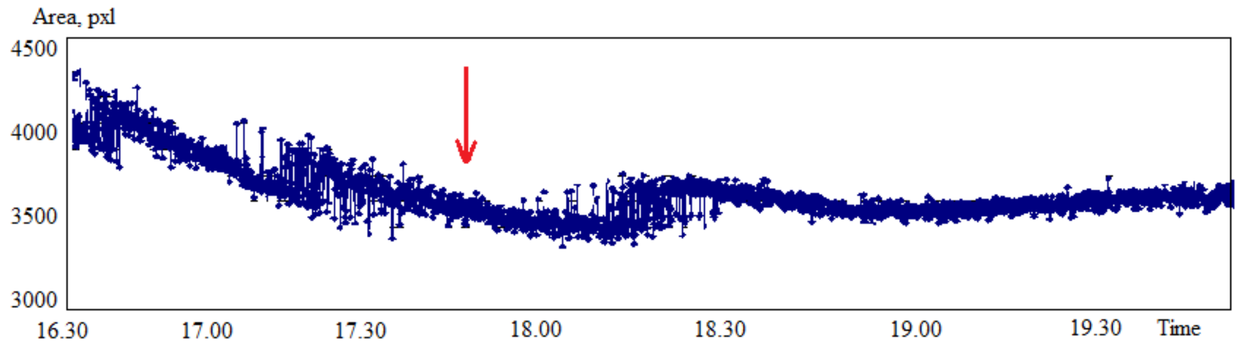


Figure 7. Temporal dynamics of changes in the area of the signal of "GDV Sputnik" during a total solar eclipse in Novosibirsk 01.08.2008 at two measurement points. The arrow shows the moment of complete coverage of the disk of the sun by the moon shadow.

Measurements have shown that the device responds to the phases of the moon, sunrise and sunset in the southern countries, where this process has a distinct character; variability of the signal increases significantly in geoactive areas[28]. Vadim Seyidov in Berlin conducted measurements with "GDV Sputnik" at the same time of the day during the year. He found that the amplitude of the signal varies significantly during the full moon phase[29]. Of particular interest is the measurement of subliminal psycho-emotional reactions of groups of people.

In 2012, experiments to study the impact of low-intensity sound on the human operators were conducted. The studies were conducted in a classroom environment with controlled parameters. In a first step, the GDV device was installed in the empty audience and one hour after the background recording a sound generator was turned on. There have been no change in the signal. In the second stage, after recording the background in an empty audience 10 students were invited to the room to work on the computers. 15 minutes after they begin to work low intensity sound was turned on for 30 minutes with parameters at the border of the human hearing range - about 20 Hz and about 20 kHz. Recording was proceed for 15 minutes after turning off the sound. In addition to measurements with the "GDV Sputnik" participants filled the questionnaire for assessment of mental and emotional state (health, activity, mood)[30] at the beginning and at the end of the experiment. All participants gave their consent to participate in the study, but did not know at what point in time the low-intensity sound would be turned on.

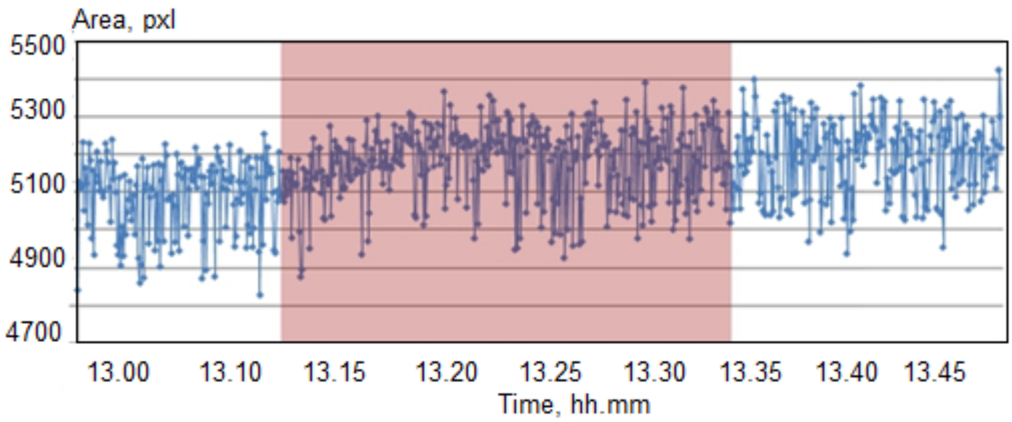


Fig. 8. Change in GDV signal during the experiment; red area allotted time of low-intensity sound 20Hz frequency operation.

Variance analysis of data has proven that there is a statistically significant difference with a probability of more than 99% between the background signals, signal in the time of the sound and after switching sound off.

Table 1: Results of calculating the area and SD area during the experiment.

Parameter/Time	1. Background	2. First 10 minutes of sound	3. Last 10 minutes of sound	4. Sound off
Area	5080	5191	5178	5198
St. Deviation	95.1	73.6	194.0	101.1

$p < 0.005$ comparing intervals 1-2, 1-3, 1-4, 2-3

Exposure time can be divided into two distinct phases: the first phase was an increase in the area of GDV signal and reduction of SD; and in the second phase the area stabilized and SD turned back to the original background level with a slight increase. Interpretation of the data may be as follows: immediately after the sound was turned on organisms of computer operators succumbed to stress (minimum SD value - minimum activity), but after some time their systems adjusted to the influence, which resulted in the return of SD to the background value. Accordingly, the work in this mode should lead to accelerated depletion of the body reserves, which was confirmed by psychological tests (see Table 2).

Table 2: Mean group psychological parameters

Wellbeing		Activity		Mood		Averaged values	
Before	after	Before	after	Before	after	Before	after
5.54	4.5*	4.78	3.7*	5.36	4.7*	5.23	4.3*

*$p < 0.05$

Normal assessment by this method should be in the range 5.0 - 5.5 points. Analysis of the data of table 2 shows that initially all parameters were within the normal limits, while after the operation there was a significant decline.

In the control experiment without the sound neither "GDV Sputnik" no psychological assesment did not reveal statistically significant reaction of the participants. Also, there were no changes in the signal of "GDV Sputnik" in an empty room to the 20 Hz sound.

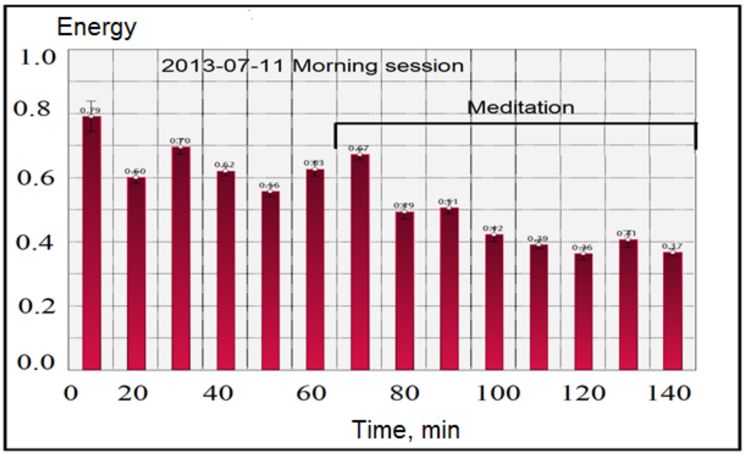
Based on these data we can conclude that the developed system and methodology allow us to study the change of mental and emotional states of groups of people. Psycho-emotional state closely associated with the functional activity of the various systems of the human body, such as the nervous system, the endocrine system, the cardiovascular system. Establishing direct connection of the signal with the functional activity of the various systems of the human body requires more research.

In 2009-2014, various researchers in Russia, USA, India, Italy and the Netherlands have held more than 100 measurements during social events, and in all cases reaction to the change of mental and emotional state of the members of the study group was recorded. Studies have shown that the higher the standard deviation of the GDV area, the higher functional activity of groups of people in the test room.

As an example, let us discuss results of a series of measurements in the United States during a workshop conducted by Joe Dispensa 11-14 July 2013. The workshop was attended by 113 people who listened to lectures and had a collective meditation for 80-90 minutes twice a day. Joe Dispensa guided the process of meditation in the hall with calm music. "Bio-Well" device with "Sputnik" sensor and the computer were installed in the corner of the room, the recording was carried out automatically with the processing of data on the server in real time every day before and during meditation in the morning and afternoon session for 6-8 hours continuously.

The day before the seminar recording of a sensor signal for 4 hours in an empty workshop room was conducted. After establishing a stable signal level 20 minutes after the start of measurement variability signal does not exceed 10-15%.

Analysis of the data showed a decrease in the signal of the sensor in the process of meditation (Figure 9). Signal processing data were broken up into 10 minute intervals, allowing calculates the average values and standard deviations. Statistical comparisons of adjacent intervals with parametric and non-parametric method was done.



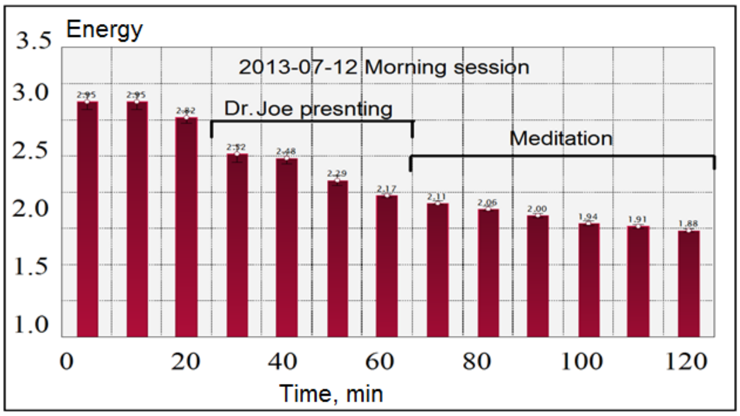


Fig. 9. An example of a signal processing recorded during a morning session on 11 and 12 July 2013.

Decrease in the signal in the process of meditation for all 4 days of the workshop was observed. During the break, the signal level increased. There was also an increase in the signal from day to day (Figure 10). In carrying out control measurements in different areas in the absence of the public, this effect was not observed.

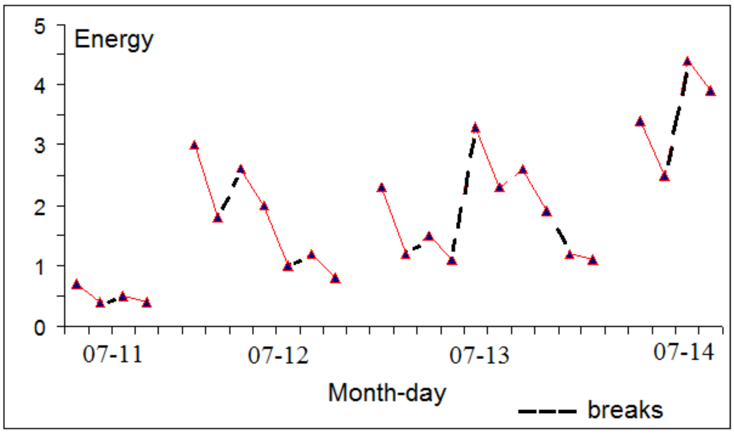


Figure 10. The mean values of the signal energy at the beginning and end of each session during the 4 days of Joe Dispensa seminar.

Similar measurements were carried out repeatedly at various seminars. Both the analogous effect of reducing the signal and no statistically significant changes were observed.

An interesting trend is the measurement during musical performances. Numerous experiments have shown that in most cases the output signal of the device changes significantly at the "live" musical performances.

Conclusion

The use of GDV in conjunction with a special antenna "GDV Sputnik" allows monitoring both non-selective characteristics of the environment and the functional state (in particular emotional state) of groups of people. The developed method was tested during theater performances and concerts, workshops and lectures, as well as in the process of group meditation. In many cases correlation of GDV parameters variations and emotional state of the audience was recorded. The lowest values of the standard deviation correspond to quiet functional state of people. Accordingly, the larger the standard deviation, the higher functional stress of people being in the room. The developed system has two sensitive elements: antenna "GDV Sputnik" and the gas discharge itself, which makes it non-selectively sensitive to changes in chemical and physical characteristics of the surrounding space.

Correlation measurements are planned to link the signal of the experimental system with changes of physiological parameters such as EEG, ECG, GSR, etc.., as well as changes in the level of infrasound, ultrasound, noise pollution, radiation, electromagnetic fields of different range and amplitude.

A series of devices to work with the sensor is developed and produced. Data processing can be carried out both in the computer and on the server in real time (www.bio-well.eu). Russian Company avdspb.ru offers services in the comprehensive analysis of environmental parameters as in the open air and indoors. It is interesting to carry out measurements in crowded places: in the theater, concert hall, lecture hall and in the church during the service. After an appropriate studies sensor can be used in education, security services, geophysics, study of geo-active zones. Currently, different researchers use more than 100 devices with a "Sputnik" sensor.

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