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Color Coronal Spectral Analysis of Bioelectrical Effects of Humans and Water

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Abstract

Color coronal discharge spectral analysis was performed on electrophotographs taken from thumbs of experimental subjects. Coronal discharge was produced by pulses of 15 kHz alternating voltage with 15 kV amplitude applied to a transparent Hostaphan electrode. Statistically significant relation was found between characteristics of photographed discharges and health status of experimental subjects. An energy threshold of photon emission was defined as 2.54 eV. Greater values corresponded to normal bioelectrical status. In some cases, values greater than 2.90 eV were measured. They were generally connected with practice of yoga, sports, etc. Values less than 2.53 eV were typical for experimental subjects with reduced bioelectric activity.

Keywords: Color Coronal Spectral Analysis, biological objects, water drops

1. Introduction

The method of Color Coronal Spectral Analysis is applied used in investigation of the biophysical state of experimental subjects [1]. The coronal effect is caused by high frequency discharge in gaseous medium. The color of light emission depends on the type of gas and not on the electrodes material. Color coronal glow provides specific biological information from experimental objects/subjects. Marinov has pointed out that such a phenomenon cannot be adequately described with modern physical views concerning the color of light emission from the gas discharge. Observation of different colors confirms the possibility of selective influence on the process by experimental objects/subjects. Along these lines, new opportunities for research and characterization of their qualities and properties could be utilized. Moreover, new approaches have been discovered for characterization of changes in biological functioning after certain types of influences [2]. Research conducted between 1998 and 2000 with 1120 black-and-white photographs showed that the method of direct analysis of gaseous glow is not diagnostic [1].That method was known as Selective high frequency discharge (SHFD) [3]. Subsequently, in cases of patients with deteriorated biophysical condition, needing medical help, Korotkov applied software processing of

Images obtained with his GDV (Gas Discharge Visualization)method and showed their diagnostic value [4].

Fritz-Albert Popp, Hugo Niggli et al.developed a method for biophoton registration based onthe low-power electromagnetic emission of living cells. The method could discriminate between healthy and cancer cells [5, 6]. Neshev and Kirilova studied possible non-thermal effects of millimeter electromagnetic waves on biological objects based on electron and proton transfer [7, 8].

Godyk and Gulyaev have conducted extensive research on weak static fields and electromagnetic emissions form living organisms, demonstrating their relevance to biological regulation [9, 10].

Direct influence of coronal emission on a photosensitive material is a method of superior quality compared to registration of the same emission with photographic cameras. Its lowest detectable energy of 1.82 eV corresponds to red color, while the highest are blue –2.64 eV and violet -3.03 eV. During gas discharge, green color glow is not observed. On the other hand, digital photography is only able to detect blue and violet color [1].

Conductivity of experimental objects/subjects does not influence image formation. However, the latter depends on the distribution of dielectric permittivity [11,12, 13].

Corona gas discharge produces typical glow. During the process, in the ionization zone, sliding discharge develops on a dielectric surface, powered by a non-uniform electric field near an electrode with a small radius of curvature. In the small gap with thickness of ~10–100 μm between the experimental object and the electrode, the following processes take place:

1) Excitation, polarization and ionization of nitrogen (78 % N_2), oxygen (21 % O_2) and carbon dioxide (0.046 % CO_2) molecules by high-frequency electric field. As a result, ionized gas is formed, i.e. gas with separated negatively charged electrons and positively charged ions, creating a conductive plasma medium ;

2) Formation of weak electric current predominantly by free electrons. The shape of glowing gas discharge, its density and surface brightness distribution is determined mainly by electromagnetic properties of the experimental object;

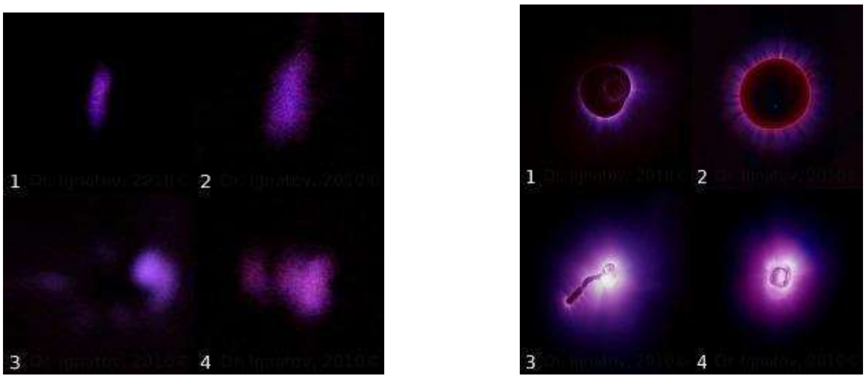
3) Transition of electrons from lower to higher discrete energy levels and vice versa, accompanied by emission of photons. The transition energy of electrons depends on the external electric field and the electronic states of the experimental object. Therefore, in different volumes within the electric field, electrons receive different quantities of energy and may "skip" some energy levels while causing photon emission from others. The result is characteristic contour and coloring of the glow.

The processes outlined above form the total gas electric effect (Ignatov, Mosin, 2012; 2014) which allows for investigation of the electrical properties of experimental objects/subjects during their interaction with external electromagnetic field [14, 15].
Electric discharge per unit area of the recording medium can be expressed as follows (Antonov, 1995):
$\sigma = [\boldsymbol{\alpha} - U_p(d_2+\delta)/d_2]\boldsymbol{\varepsilon}_0(d_2+\delta)/\delta d_2,$ (1)
where: $\delta = d_1/\boldsymbol{\varepsilon}_1 + d_3/\boldsymbol{\varepsilon}_3$
α – electric pulse slope rate;
T – electric pulse duration;
U_p– breakdown voltageof the air gap between the experimental object andthe recording medium;
d_1– thickness of the object;
d_2– thickness of the air gap;
d_3 –thickness of the photosensitive material;
ε_0 – dielectric permittivity of air (ε_0 = 1.00057 F/m);
ε_1 – dielectric permittivity ofthe experimental object;
ε_3 – dielectric permittivity of the photosensitive material.

The breakdown voltageof the air gap is:
$U_p = 312 + 6{,}2d_2$ (2)
Consequently,a quadratic equation describing the widthof the air gap is obtained:
$6{,}2d_2^2 - (\boldsymbol{\alpha}\mathbf{T} - 6{,}2\delta - 312)d_2 + 312\delta = 0$ (3)
It has the following solutions:
$d_2 = [\boldsymbol{\alpha}\mathbf{T} - 6{,}2\delta - 312] \pm [(\boldsymbol{\alpha}\mathbf{T} - 6{,}2\delta - 312)^2 - 7738\delta)^{1/2}$
So, for achievement of reliable results, geometry, dielectric properties and voltage characteristics of the experimental setup should be adequately combined. The

method for SHFD has application for research of electrical parameter of water drops in gas discharge conditions [16].

As an illustration, color electric images of water droplets of different water types had been previously studied with the method of Color Coronal Spectral Analysis (Ignatov, 2010). This experiment showed the relation between electric glow characteristics, rotation of polar water molecules and their structural arrangement in the investigated samples [17]. Different electric images (Fig. 1) were produced by different water samples indicating their different response to the oscillating external electric field (Ignatov, 2010).



a. b.

Figure 1. Digital Color Coronal Photography of water drops (a) and on photographic film (b): 1 drop - tap water, 2 mountain water drop, Teteven, Bulgaria, 3 drop - seawater, Hammamet, Tunisia, 4 drop - karst and mineral water, Zlatna Panega, Bulgaria

These findings point to self-organization resulting from polarization and structural arrangement of water clusters, thus making possible information storage in living cells. Highest structuring is observed for molecules in mineral waters that interact with calcium carbonate, followed by those in sea water, depending on their polarization as model system for origin of life [18,19, 20]. Additional spectral analysis shows that the types of water with the more distinct electrical images have more distinct peaks in their spectra.

The aim of the present work is to show the feasibility of color coronal discharge for investigation of experimental subjects.

2. Materials and Methods

Gas discharge emission was investigated in a dark room with red filter lighting. It was registered with photosensitive paper or color film placed on the transparent Hostaphan ® electrode with 87 mm diameter. It was filled with conductive liquid composed of 1% NaCl solution in deionized water. The rear side of the electrode was covered with thin copper coating. Investigated objects (water drops, human thumbs) were placed on the corresponding photosensitive material. Pulses with 15 kV voltage and carrier frequency 15–24 kHz were applied between the objects and the electrode copper coating.

The functional scheme of the gas corona discharge device is shown in Figure 2.

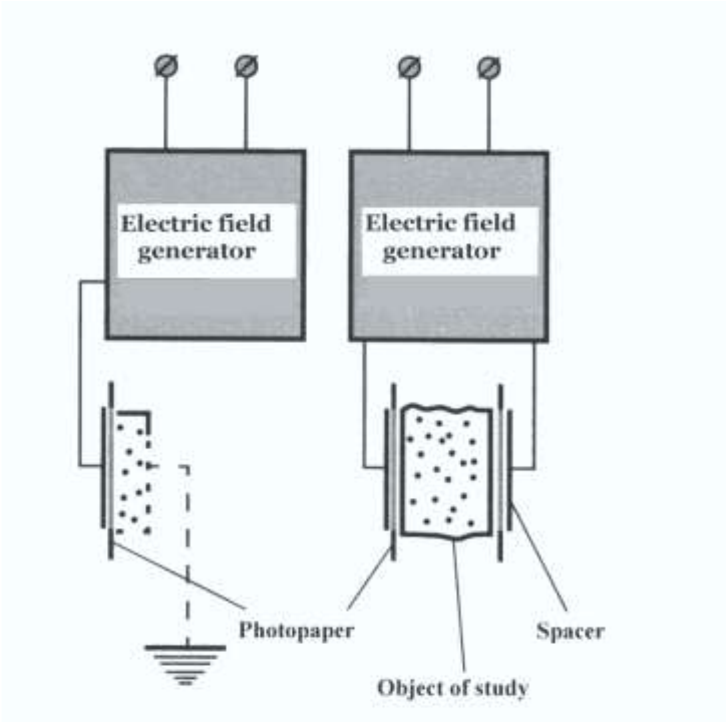


Figure 2. Functional scheme of the gas corona discharge device

Corona gas discharge was generated in the gap between investigated objects and the transparent electrode (Fig. 3) producing characteristic glow around the contact area. Its electromagnetic emission in the ranges 380–495 and 570–750±5 nm illuminated the corresponding photosensitive material according to objects' specific properties. Color images produced by visible, UV and IR radiation were processed and analyzed with a dedicated software package. Measured spectral characteristics were calculated in electron volts (eV). Statistical analysis was performed with the STATISTISA 6 package using Student's *t*-test (at $p < 0.05$).

Figure 3. Transparent electrode with 87 mm diameter made of Hostaphan® and filled with conductive liquid (1% NaCl solution in deionized water)

3. Results and discussion

3.1. Characteristics of color coronal glow

Bioelectric activity in the human body influences the intensity of gas discharge glow. And bioelectric activity itself is influenced by various kinds of pathology. This causal connection is reflected in the shape and color of gas discharge glow, which is characterized mainly by photon energy emission during electron transitions from higher to lower energy levels as a result of excitation by external electric field. Thus, for red color in the visible electromagnetic spectrum, this energy corresponds to 1.82 eV, for orange – to 2.05 eV, for yellow – to 2.14 eV, for blue-green (cyan) – to 2.43 eV, for blue – to 2.64 eV, and for violet – to 3.03 eV (Fig. 4). The reliable result threshold is $E \geq 2.53$ eV [1, 21, 22, 23, 24].

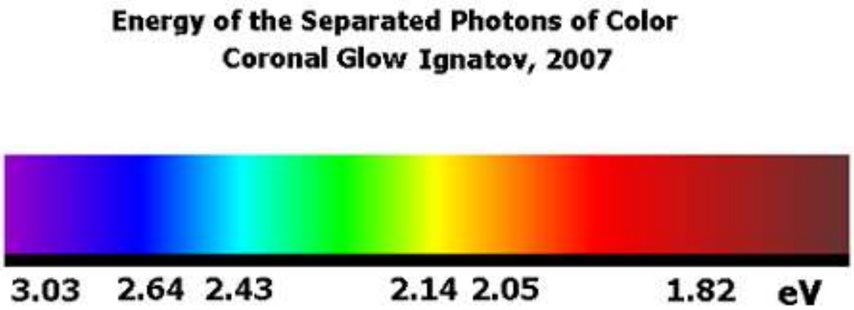


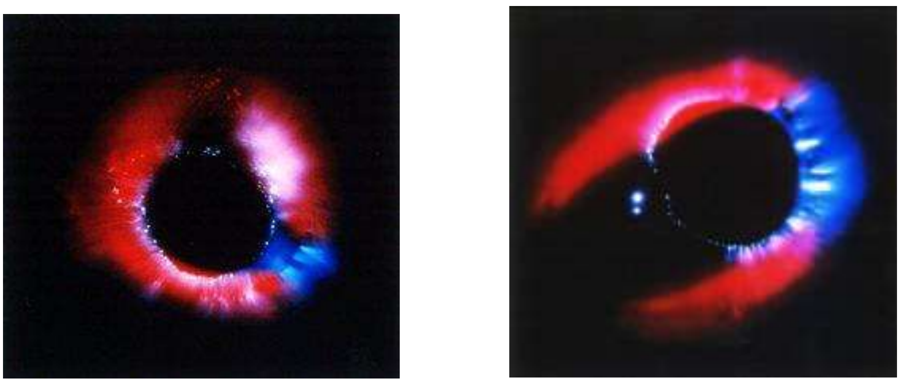
Figure 4. Spectrum of color corona gas discharge emission

The spectral range of the photon emission for the different colors is 380-495 nm and 570–750 nm±5 nm. Photons corresponding to green color emission were not being registered by the experimental setup in this study. In general, pathologies in the organism alter bioelectric activity which in turn reduces the apparent size of the gas discharge glow. This dependence was observed for many types of disorders, although statistically reliable results should further be obtained in order to possibly apply this method for medical diagnosis. For the purpose of this study, experimental subjects' contact area of the thumb with the transparent electrode was investigated.

3.2. Corona discharge from experimental subjects

An energy threshold of photon emission was defined as 2.54 eV. Greater values correspond to normal bioelectrical status. In some cases of experimental subjects, values greater than 2.90 eV were measured. They were generally connected with practice of yoga, sports, etc. Values less than 2.53 eV were typical for subjects with reduced bioelectric activity. These results point to further opportunities of development and possible application of this method in biophysical studies [1, 13]. Figure 5 shows the photographs of color bioelectrical photographs.

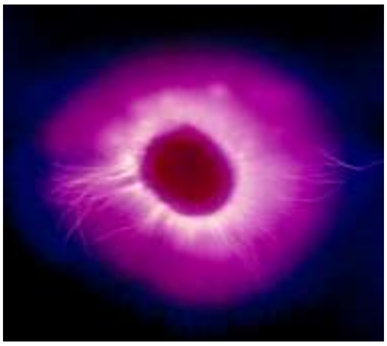
Figure 5 shows an example of normal emission and another one after appendectomy.



a b

Figure 5. Examples of different types of emission: a) normal and b) after appendectomy

Figure 6 illustrates two observed cases of higher bioelectrical activity: those of Christos Drossinakis and Bettina Maria Haller.



a.

b.

Figure 6. Photographs of higher bioelectrical activity displayed by Christos Drossinakis (a) and Bettina Maria Haller (b)

Figure 7 presents a black-and-white photograph of corona discharge from Christos Drossinakis taken in 2001 [13]. As it can clearly be seen, the color photography method described here provides much bigger information content.

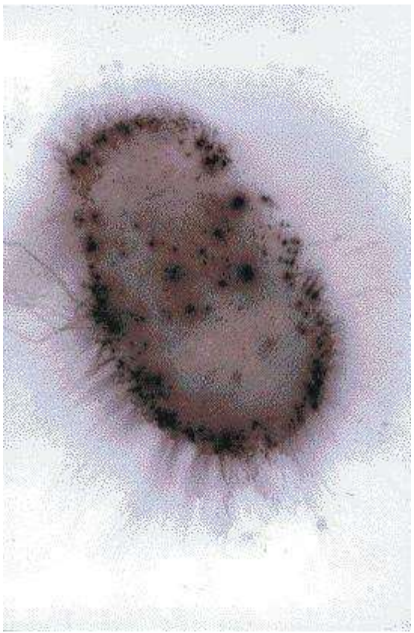
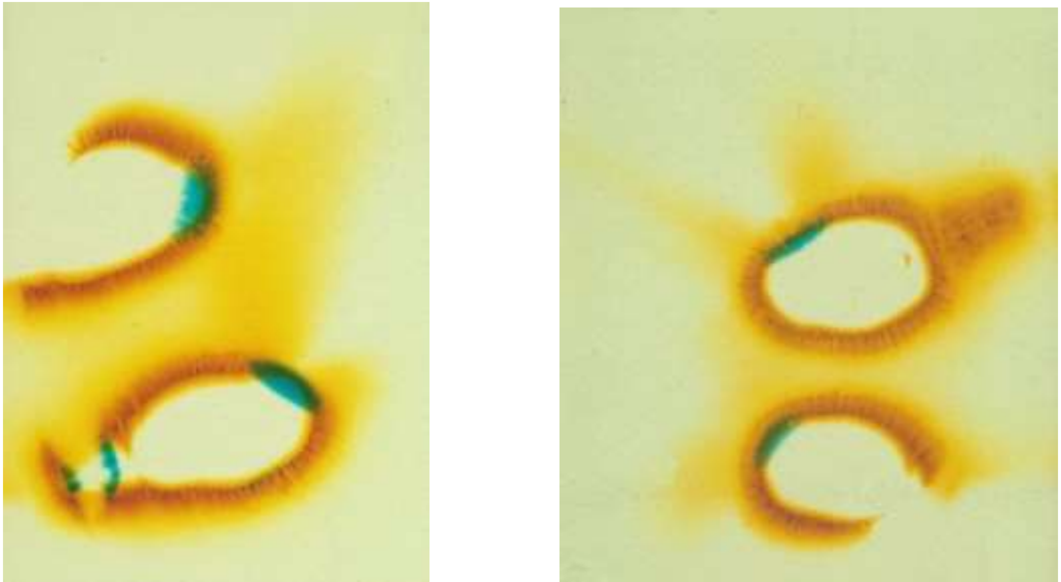


Figure 7. Black-and-white photograph of corona discharge from Christos Drossinakis

3.3. Simultaneous corona discharge from two experimental subjects

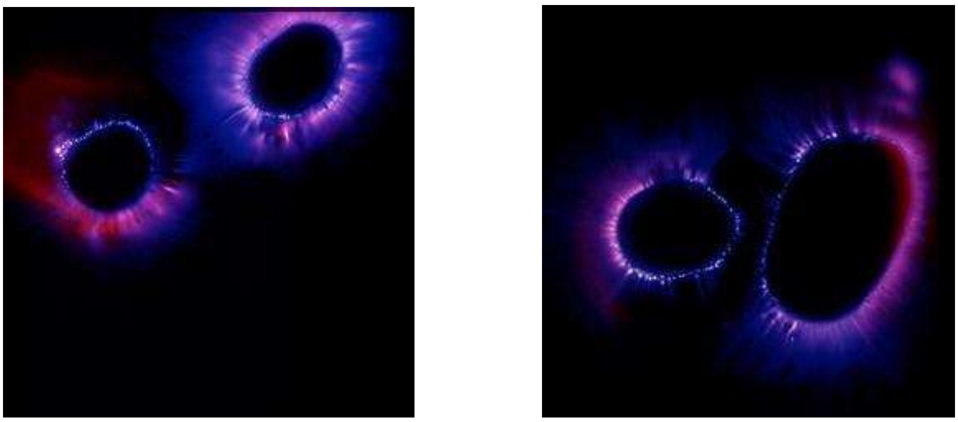
The experimental setup allows for photography of simultaneous corona discharge from two experimental subjects [13]. Depending on mutual influence on skin resistance, strongly and weakly coupled images are possible. Such an experiment was initially performed by Antonov and Galabova in 1990 (Fig. 8 a, b).



a. b.

Figure 8. Strongly (a) and weakly (b) coupled corona discharges between the thumbs of two experimental subjects (Antonov, Galabova, 1990)

An upgraded version of the experiment was performed by Ignatov in 2010 (Figure 9 a, b).



a. b.

Figure 9. Strongly (a) and weakly (b) coupled corona discharges between the thumbs of two experimental subjects (Ignatov, 2010)

4. Conclusions

Color coronal discharge spectral analysis was demonstrated as a feasible method for investigation of biological functioning of experimental subjects. Optimal selection of voltage characteristics as well as of geometry and materials of experimental setup allows for highly informative photography of discharges starting from human skin surfaces. Further efforts are necessary towards accumulation of statistically significant bodies of data concerning interrelation of discharge characteristics and changes in particular physiological processes.

The basic research of Kirlian is for photographing objects in the high-frequency electric discharge [25]. Pehek and Kyler were performed development of corona discharge photography [26].
In addition, almost six decades after the appearance of Schaffert's "Electrophotography" book, there are tangible possibilities to advance corresponding technology for direct capturing of corona discharges from biological objects, especially around larger contact surfaces [27].
Electrophotography is by far the biggest of all the reprographics technologies. These seemingly inconsistent statements make sense only when it is realized that electro-photography comprises the two very familiar and ubiquitous technologies of photocopying and laser/LED (light emitting diode) printing.

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