Kirlian Photography Techniques and Equipment

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ABSTRACT

Kirlian Photography was first developed in the Soviet Union and was unheard of in the West for decades. It was then enthusiastically accepted not only by the scientific community but also by parapsychologists.

Kirlian Photography has the potential to be devel- oped into a non-invasive diagnostic technology that could ultimately be made available for a much lower cost than alternative technologies.

This paper describes the physical basis of Kirlian Photography, it's manifestation, and the technologies used in its implementation.

INTRODUCTION

In 1939, Sernyon Kirlian, a Russian, discovered that if an object on a photographic plate is subjected to a high-voltage electric field, an image is created on the plate. The image looks like a halo and is a visible corona discharge that is also visible in high voltage power distribution systems. This image is said to be a physical manifestation of the *aura or life force* that allegedly surrounds each living thing.

Despite various claims, the Kirlian images produced by the so called "Kirlian Effect" are due to corona discharge caused by the application of short bursts of very high voltage at high frequency for a period of time long enough to take a photograph of the resulting discharge. The method of generation and the details of the waveforms are complex but essentially an ordinary corona breakdown phenomenon occurs on each positive and each negative half cycle of the high voltage waveform.

Thelma Moss visited the USSR, including Moscow, Leningrad and Aima-Ata in 1970 as well as Prague and Sofia. She was especially invited to the Kirov State University of Kazakhstan, biology department, which had done extensive research into scientific ap- plications of Kirlian photography [1, 2]. This

eventually led her to set up the first full scale Kirlian research program in America.

William Tittler, travelled to the USSR with a group of scientists, doctors, and laymen from the Association for Research and Enlightenment, visiting Moscow and Leningrad. Tittler learned a great deal about Kirlian photography, which he has published in detail along with technical plans [3]. At Stanford Tittlerassembled equipment designed to approximate the Soviet technique [4].

Moss, popularised Kirlian photography as diagnostic medical tool with her books *The Body Electric (1979)* and *The Probability of the Impossible (1*983). She was convinced that the Kirlian process was an open door to the *bioenergy* of the *astral body*.

The main use of Kirlian Photography is as a fast, in- expensive and relatively non-invasive means for the diagnostic evaluation of physiological and psychological states [5].

Among the initial fmdings is that disease shows up in a disturbed pattern of flares long before it manifests in the physical body in any diagnosable form. The pat- terns of the flares are substantially altered by the weather, day and night, cosmic disturbances such as solar flares and psychological states such as stress. The brightest flares on the body show at the points on the skin known to be acupuncture points.

The Kirlian photography process itself is not a psychic event, and has nothing whatever to do with occultism any more than the electroencephalograph. Kirlian photography devices, developed for use in scientific research, can also applied to studying psychic events.

In its basic form the Kirlian technique uses a Tesla Coil connected to a metal plate, on which are placed the film and object to be photographed, in the dark. Switching on the high voltage, high frequency electricity causes the film to record an image of the object surrounded by a corona discharge field. Non living things such as coins give a constant unvarying piemre. Living things exhibit continuously changing patterns.

The originality of the Kirlian method does not lie in the development of the high frequency spark generator itself, but in the wide range of patented apparatus that make it possible for the spark generator to be used in a variety of photographic applications.

A large number of researchers have succeeded in constructing electrogmphic equipment and making photographs. In 1972 scientists from Stanford, UCLA, Newark College of Engineering, the University of New Mexico, Roger Williams College and others, gathered at the First Western Hemisphere

Conference on Kirlian Photography and Acupuncture in New York. Several hundred people attended [6].

KIRLIAN PHOTOS - WHAT DO THEY SHOW?

Some scientists think that stimulating the skin with the high frequency electric fields used in Kirlian photography simply causes the body to radiate electrified particles, which show up in the photos as different patterns. They call this *cold electron emission, and* physicist Victor Adamenko [7, 8, 9, 10] says it might have its roots in the same level of substance as the aura. Some Western scientists say this theory cannot account for all the light given off. Others insist that Kirlian photography is amplifying a different energy within the body, which they call *bioplasmic energy* [11]. They envisage the bioplasma body as a kind of energy counterpart of the physical body.

There is also evidence that Kirlian images can be used for diagnostic purposes [5, 12]. The Kirlian photos have so far proved to be a means of early detection of illnesses, which show as disturbed energy patterns in the pictures. It is possible perhaps, to prevent illness, by re-balancing these disturbed energies seen in the Kirlian photos, and this might be what acupuncture treatment does.

There is a rich assortrnent of material available on the Web, for example at UC Davis [13]. Extensive indexes and descriptive materials, some of which are far from scientific, are also available [14, 15].

CURRENT EQUIPMENT

Electronic versions of Kirlian equipment contain not only a CCD camera but also the high voltage genera- tor and its controller as shown in Figure 1. The video image is captured using a standard PC compatible video capture card. This captured image is then proc- essed by computer, to produce the coloured images used for diagnosis.

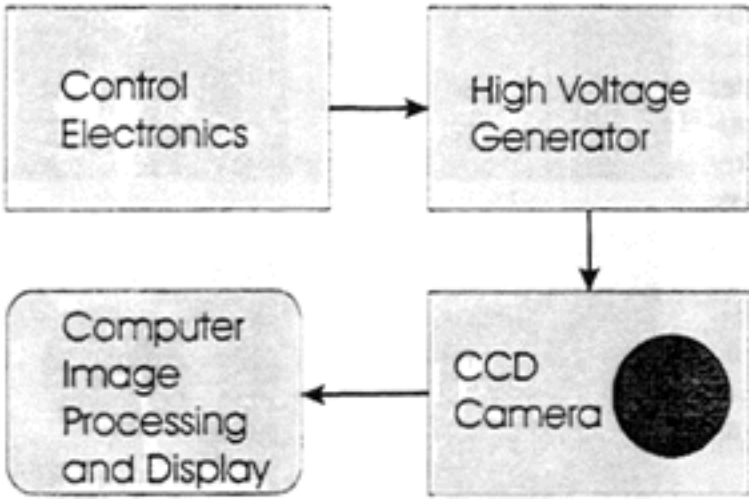

Figure 1 - Block diagram of Kirlian CCD Camera

The control electronics module contains most of the electronics for the operation of the system. There are typically three sets of controls.

• Voltage adjustment over the range of 4-20 kV.

• Repetition rate from 8 Hz to 1 kHz

• Output duration from 120 msec to 60 seconds.

These settings reflect the experimental nature of Kirlian photography as typically a voltage above 10 kV is used with a repetition rate of 1 kHz to obtain a suf- ficiently bright image. A period of about a second is typically used to enable checking of finger position and reading of the actual image intro the computer.

MONASH INTEREST IN KIRLIAN PHOTOGRAPHY

The interest of the Monash Biociectronics Group in Kirlian photography was stimulated by our interaction with Dr Vagif Soultanov of Eastok Pty Ltd.

Kirlian photography is said to provide not only diagnostic information, but an assessment of the overall energy state of the body. It therefore has potential to be used in a wide range of applications [16, 17, 18, 19].

It is our aim to investigate these claims with particular emphasis on:

• Ability to understand and monitor a patient's stress levels [20].

• Ability to understand the condition of the body and its susceptibility to certain diseases to enable early treatment or preventative action to be taken.

• Analysis of the effectiveness (and side effects) of therapeutic drugs, rnedicinal herbs, homoeopathic remedies, together with acupuncture, chiropractic and osteopathic treatment.

• Analysis of the impact of food intake or dietary habits on general health.

CURRENT DEVELOPMENTS

Typically it is the fingertips that are photographed, together with the corona that is formed around them due to application of the high voltage field. The corona breakdown mechanism itself is complex and is also substantially different for positive and negative voltages [21]. There is however, no "discharge" from the finger and it is unlikely that there is a "bioplasma" which lights up due to the applied alternating electric field. Moisture on the finger serves only to provide a somewhat more conductive path at the surface of the finger, from which a higher discharge current may flow. Humidity of the atmosphere and surface rough- ness of the :finger will change the breakdown voltage of the air surrounding the finger (as influenced by local curvature [21], just as it has an effect on high voltage electricity trammission lines.

The Kirlian Phenomenon can be described asfollows:

The air between the fmger and the plate to which the high voltage is applied, ionises. This ionisation occurs, due to the electric field strength applied, which is of uniform strength (gradient) between the point on the finger and a point on the plate. Air ionises by stripping electrons from the atoms of the gases of air, predominantly that of oxygen, so that free electrons (negative) and free oxygen ions (positive) are generated. Because of the uniform potential gradient of the field from a point on the finger and a point on the plate, ionisation can occur anywhere in that particular air path and is not concentrated at either end. The field being electromagnetic, propagates at the speed of light, so that there is no distance effect to cause ionisation in proximity to the finger or the plate. However once ionised the electrons are attracted to the positive end and the ions to the negative end of the field. The intense electric field causes them to accelerate rapidly and the crash into other gas atoms thereby releasing additional showers of charged particles. It is these high-speed collisions that release photons and cause the visible corona [21].

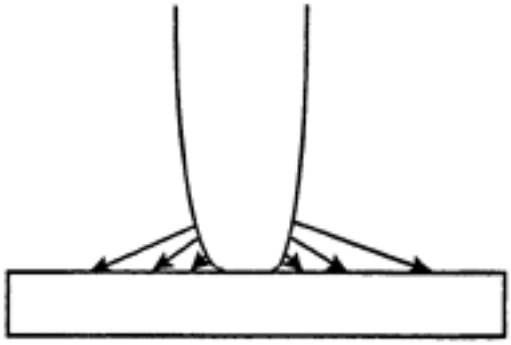

Figure 2

The finger is usually placed so that the tip touches an insulating glass plate, and is perpendicular to it as shown in Figure 2. The arrows show some electric field vectors. It can be seen that the electric field paths to the plate increase in length as they go further from the finger. Therefore the breakdown voltage requirement also increases with distance, because air has a nominal breakdown strength of about 10 kV/cm. As the applied voltage increases, then also the diameter of the corona increases.

The velocity of ions is limited by the speed of sound in air, about 330 mlsee or 3.3 mm in a 10 gsec half cycle of the applied waveform. The visible coronas are frequently much longer than this, and the velocity of the ions is more likely to result in path lengths of less than a millimetre, indicating that ionisation does indeed occur simultaneously with a random distribution over the entire path length. Collisions are frequent and the ions recombine with electrons in a very mean short path length. On the other hand, with a sufficiently intense electric field, secondary ionisation by collisions may become greater than the recombination rate, causing arcing through the generated plasma of ionised gas. Transition into this mode of operation is quite broad, and it appears that Kirlian photography operates in this region of arcing onset.

The colours shown on Kirlian photographs are artefacts of the photography system and do not have a correspondence in the Kirlian discharge phenomenon. Colour fihns are constructed in three colour sensitive layers. Therefore, ions or high energy photons from ion interactions will penetrate to different emulsion layers in the film depending on their energy. In this way, it can be said that the colour is dependent on the structure and composition of the film and the energy of the ionised particles. Logically then, if there is a large quantity of ionisation then all the layers will be activated (exposed) causing a white image to appear. In this context, small adjustments of the high voltage potential, its frequency, the exposure tirne and the weather can produce dramatic changes in the photographic outcome.

With modem CCD (television type) cameras the captured image is monochrome (black and white). This image is then processed by computer to standardise some of the parameters and is then endowed with artificial colour depending on the image intensity. This process is subjective too, and can result in quite different appearance depending on the processing employed. However, as the colours only denote intensity variations and not an absolute colour, indicating the state of the aura or any other interpretation of its cause, then the interpretation of these colours is not a matter of getting the right colour but in observing patterns and shapes. The operators are therefore able to set the equipment to their own preferences, so as to facilitate interpretation. This still leaves the question of standardisation that is required, if Kirlian images are to be used for cooperative work and interchange.

SOME IMAGE PROPERTIES

The diagrams of Figure 3 illustrate the effects of some simple image manipulation, as can be performed by any of the current range of photo editing tools. The original picture is taken using an UWS diagnostic system camera [5]. It is generally representative of images used by the system for computerised colour- ing to obtain the images actually used for diagnostic purposes. With computerised image processing we can readily assign any chosen colour to different lev- els of image intensity.

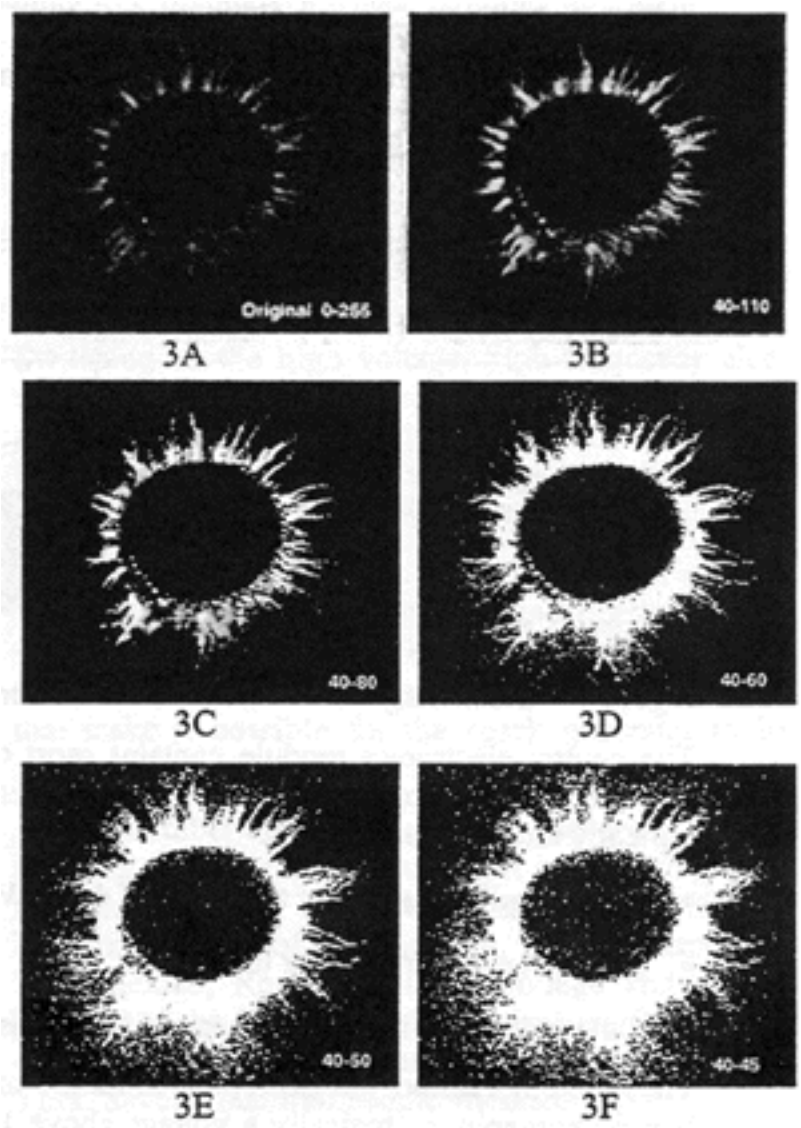

Figure 3 - Modification of image parameters

We use the term *intensity* to denote bright areas of the image. This is because. *brightness* is a technical term (which is almost invariably misunderstood) born at the beginnings of television and actually designates the

black level intensity of the image. *Contrast,* is the other term used, which indicates the contrast between the most intense bright regions of an image relative to this black level. In engineering terms the contrast is a measure of the image signal amplification.

These images, in computer terms, are recorded with an intensity range of 0-255, ie an 8 bit image. Apart from the original image (3A) the other five have had the intensity level of 40 assigned to the black level, in place of the original image's 0. In other words the lowest 40 of the original 255 intensity levels have been stripped away from the image, so as to produce a truly black background instead of the original grey. This produces a visibly darker image than the original. Contrast is then increased, so as to increase the rate at which subsequent intensity values produce more intense light in the picture.

The second image (3B), has its whitest point set at 1 1 0 of the original, so that intensifies from 1 1 0 to 255 all become the most intense, at a new level of 255. This means that the image is now composed of details originally represented by intensity levels of 40-1 10 of the original 0-255. More than 70% if the original im- age intensity information has been thrown away.

The remaining images, all have their black level set at 40 as above. The contrast is however increased progressively as shown in the captions. The third image, (3C), for example, uses only the range of 40-60 in the intensity levels of the original.

The last image (3F) uses the intensity levels of the original image, only in the range of 40-45. This bright light apparently emanating from the finger is reminis- cent of some of the published images in various colours depending on the claims made for them [22].

The original image presented (3A), was produced by a CCD camera. Similar effects could be easily pro- duced using photographic film. In the case of photo- graphic film, the increasing contrast used to generate these effects is equivalent to ever increasing overexposure. CCD cameras are increasingly being used to avoid some of the difficulties of producing repeatable results and for more rapid access to images.

CCD CAMERA

A CCD camera contains a CCD chip which has a two dimensional array of cells as shown in Figure 4. Each cell generates a voltage proportional to light intensity. The voltage (or charge) in each cell, is then sequentially shifted to the output so as to generate a television image. There are several other chips in a camera unit. These are for generating the synchronising pulses and performing many other complex tasks required to generate a television signal.

CCD-chip architecture

The CCD-chip is an optical detector. The image sur- face is divided into photosensitive sites or pixels.

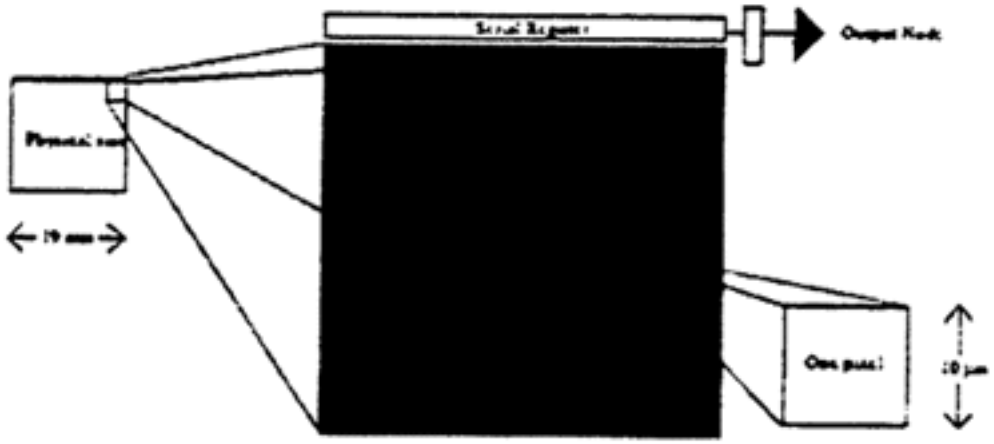

Figure 4 - CCD chip layout.

The pixels accumulate charge proportional to the in- tensity of the incident light. When the CCD is exposed to a light pattern the different pixels are ex- posed to different intensifies of light. The pixels will accumulate different charges and the charge pattern will correspond to the incident light pattern. The accumulated charge of each pixel can be read out and the light pattern reproduced in a computer.

Each pixel site is approximately 10 μm square and is constructed as shown in Figure 5. When these sites are exposed to light, charge accumulates in the poten- tial well. The total amount of charge is proportional to the product of the time the site is exposed to light and the intensity of the light.

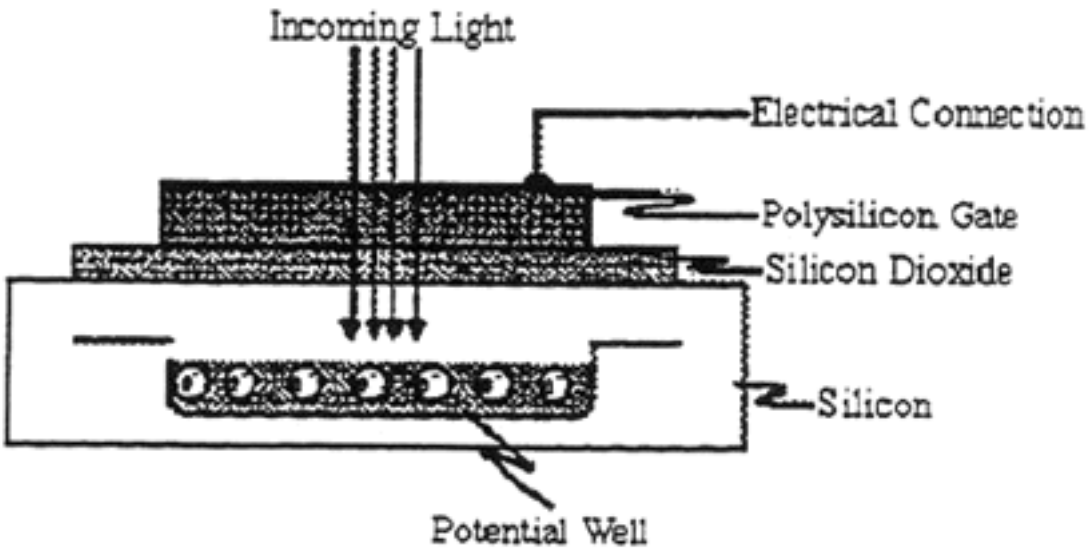

Figure 5 - Cross section of a pixel site.

The readout of the accumulated charge is done as follows; The charges are shifted row by row until they reach the "top" edge. The pixels in the top row have connections between them in the serial direction. The charges in the pixels in the top row are shifted one at a time through the output node and amplified.

CONCLUSIONS

The Kirlian phenomenon is not well understood and new research is pushing forward these boundaries of knowledge. Detailed understanding of the physical processes is not yet realised.

We have presented a brief outline of the history of Kirlian photography and its enthusiastic but some- times misguided acceptance by the West after original investigation by several reputable universities in the former Soviet Union.

We are using equipment manufactured in St. Petersburg. However, we are also in the process of developing a more complete understanding of Kirlian Photography, not only in the application and inter- pretation of images for diagnostic purposes, but also in terms of the technical requirements for generating the high ftequency, high voltage signals necessary to make it work.

The advent of inexpensive CCD camera equipment has also had a significant benefit in that rapid and controllable image generation is now possible. This eliminates a whole range of variables associated with different types of film, their exposure time end processing variations. In the absence of repeatability, it has been impossible in the past to manage meaningful correlations of results and thereby gain additional insights into the Kirlian phenomenon.

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