

PHANTOM LEAF EFFECT IN KIRLIAN PHOTOGRAPHY

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KIRLIAN PHOTOGRAPHY

Kirlian photography is an electrophotographic process where an animate object is placed in between two electrodes across which a high voltage high frequency pulse is applied. A bunch of electrical discharge channels run throughout the body of the object and an aura surrounding the object is formed, both of which correspond to the topographical condition and the physiological structure of the object. The discharge channels and the aura can be photographed by placing a photographic film or plate between the two electrodes either above or below the object under study. High voltage discharge photography is, in fact, not new and has been used from time to time, in some form or other for a long time, atleast since the turn of the twentieth century beginning with the pioneering efforts of Tesla¹. In India, Sir J C Bose had also used the technique² independently for photographing the inner structure of a plant leaf as early as 1902. Basically, high voltage discharge photography is a technique for making photographs of electrically conductive objects with no light source other than that produced by the luminous discharge at the surface of the object in a high voltage high frequency electric field.

The discharge pattern including the aura surrounding the animate object under study can also be made visible even without photographing by making one of the electrodes, preferably the upper one, transparent. In 1939 in the Soviet Union, Seymon Kirlian, an electromedical technologist was said to have rediscovered electrophotography when a photographic film which he chanced to hold in his hand was accidentally exposed to a volley of electrical sparks emanating from the plate of a diathermy machine, and the film on development showed the fingers of his hand with an aura around the fingerprints. This accidental phenomenon formed the starting point of an investigation on the photographs of objects by means of high frequency discharges by Seymon and his wife Valentina Kirlian.

During the last two decades the name Kirlian photography has been accepted as a generalized term for high voltage photography by means of high frequency currents where the applied voltage gradient is between 10^4 volts/cm and 10^8 volts/cm, and the carrier frequency associated with applied high voltage pulse is between 1 kHz and 5 MHz or even greater.

Kirlian photography promises extremely useful applications in biology, physiology, agriculture, psychology and medical diagnosis. While in general it has been

found to be very helpful in studying the structure of plant and animal cells, Kirlian photography has been found to be particularly promising in the diagnosis of carcinoma and viral infections even at an early stage. According to some medical experts, one day in the not too distant future, physicians will request in addition to a CBC, SMA, urine analysis tests for electrolytes, etc a Kirlian photograph also for their patients.

Fig 1 shows the nature of the general experimental set-up of the electrodes and the object in Kirlian photography. The object to be photographed is sandwiched between two metal electrodes together with a transparent insulation sheet and a photographic film. A high voltage high frequency pulse is applied across the electrodes one of which is generally grounded.

Fig 2 shows a typical Kirlian photograph taken by the authors of the leaf of a common Indian creeper. It is interesting to note the internal structure of the leaf as displayed by the luminous discharges. More fascinating is the aura around the leaf in the form of bunches of luminous radiations. Apart from its interest from a scientific angle, the luminous patterns inside and around the leaf appear as a creation of a graphic artist.

THE PHANTOM LEAF EFFECT

The phantom leaf effect is one of the most spectacular and unusual phenomena in Kirlian photography which was originally reported by some of the associates of the Kirlians³. It was reported by them that if a small portion of a leaf was cut away, the Kirlian photograph showed not only the portion of the leaf remaining, but also the portion of the leaf that had been physically removed. The details of the cut portion of the leaf are generally fainter than the intact portion of the photograph. Obtaining such phantom leaf effect or 'cut-leaf effect' has been rare and thus the phenomenon was not initially accepted by the scientific community as a fact. Until recently these phantom leaf photographs were obtained more by chance than by definite logical experimental conditions and the success rate of getting the phantom leaf photograph was not better than 2-5%.

PRESENT INVESTIGATION

The authors started a research programme on the technology and application of Kirlian photography under a grant from the Department of Science and Technology, Government of India, in 1978 and have

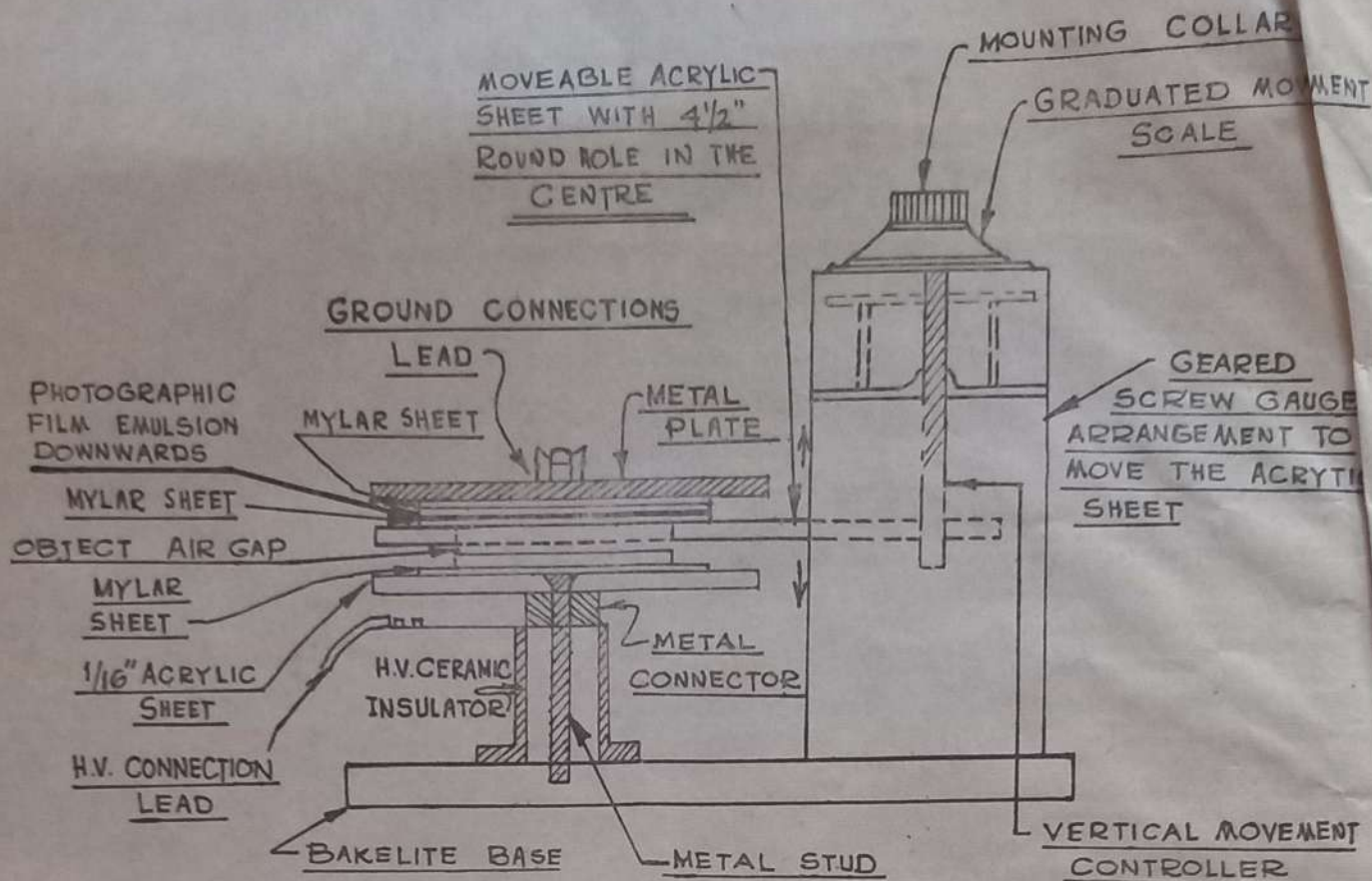


Fig 1 Experimental set-up of electrodes and object in Kirlian photography

developed a versatile high voltage high frequency pulse generator which can be used for all types of scientific and medical investigations by Kirlian photography. The authors working at the measurement laboratory of the Electrical Engineering Department of Jadavpur University, Calcutta, have recently made a major breakthrough in identifying the principal conditions for obtaining phantom leaf photographs and have achieved almost certain repeatability. They have thus opened new potentialities offered by Kirlian photography. Their success has been due to the development of: (a) a special type of maximum-aura sandwich, and (b) a special type of high voltage high frequency pulse generator having extremely flexible adjustments of the key parameters of the high voltage pulses which are necessary for realizing the conditions for successful phantom leaf photography.⁴⁻⁷

Fig 3 and Fig 4 illustrate two pairs of photographs taken by the authors showing the leaf and corresponding photographs of the cut leaf exhibiting the phantom leaf effect. They found that the sandwich used by them and the unipolar frequency-cum-amplitude modulated pulses as shown in Fig 5(a), (b), (c) were the most suitable conditions for objectifying the phantom leaf effect.

COLOUR PHANTOM LEAF PHOTOGRAPHY

The discharge channels in the body of the leaf under study in Kirlian photography are not static and also are not of a single colour. As a matter of fact, the discharge patterns are dynamic and multicoloured in nature. The multicoloured bioluminescent patterns of the Kirlian discharge channels in the plant leaves constitute a wonderful display when viewed through a special visual apparatus developed by the authors.

A glimpse of this multicoloured display of the channels and specks of light can be somewhat realized from a Kirlian photograph taken on a colour film, though they are not exact reproductions of the natural colours, nevertheless these colour photographs at least impart an idea of the multicoloured pattern of the discharge.

Kirlian photographs on colour film were taken by several earlier researchers. As far as can be known from published literatures, only a few good phantom leaf photographs in colour have been obtained by them. In the printed colour photographs, however, the phantom parts appeared almost in one colour though the rest of the leaf, i.e., the uncut part exhibited some colours. The authors were successful in obtaining phantom leaf photographs with the cut part also displaying multicoloured design just as the uncut part of the leaf so much so that it was difficult to distinguish which part of the leaf was cut off. A typical colour photograph displaying phantom leaf effect is shown in Fig 6. The cut part of the figure is identified by the black straightline mark, at the bottom left portion of the leaf.

Fig 7 shows another phantom leaf photograph of a leaf taken in colour in which the cut part is detected by a line mark. The colour of the discharge channels and also of the tiny specks of light are certainly the characteristics of the internal structure and material of the leaf and colour photography is bound to add a new dimension in Kirlian photography by providing useful information.

The authors have obtained about 30 colour photographs with phantom leaf effect. The details of the cutout part in the phantom portion of the leaf as obtained by the authors are entirely novel and unprecedented.



Fig 2 The Kirlian photography of a plant leaf



Fig 4(a) Kirlian photograph of an uncut hibiscus leaf

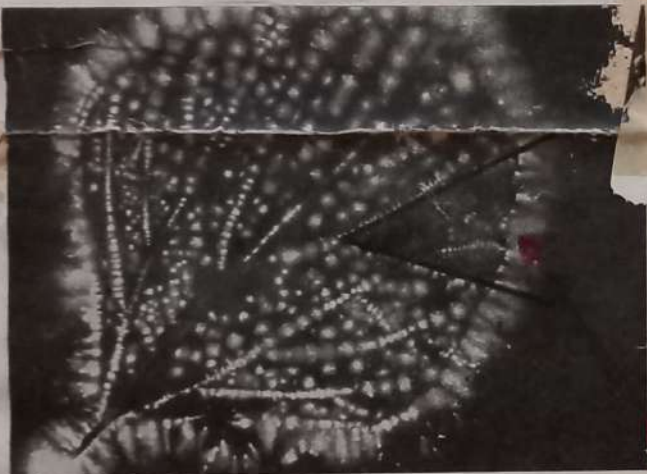


Fig 3(a) Phantom leaf effect of a leaf cut at the central part (area within black straightlines)



Fig 3(b) Enlarged view of the phantom part of Fig 3(a)

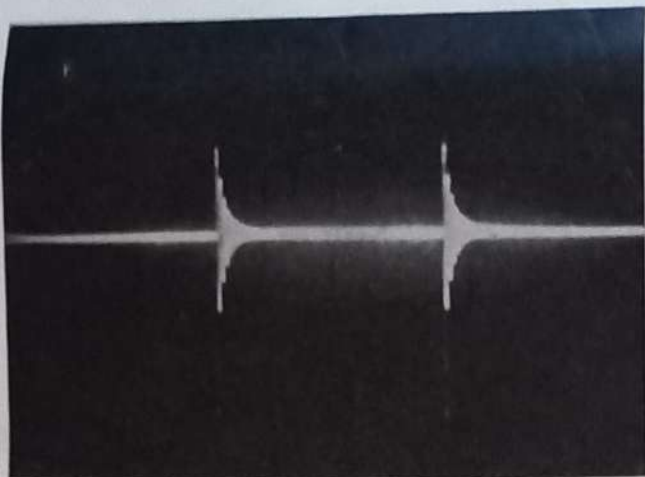


Fig 4(b) Phantom leaf effect of the same leaf of Fig 4(a) with apex cut off above the black line

These parts were absent in the leaves

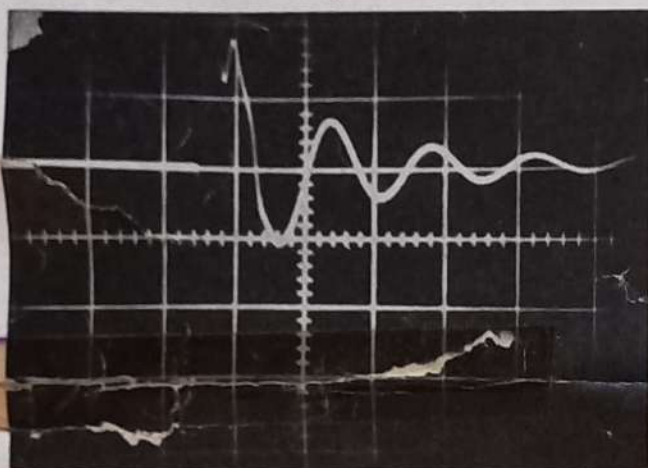
APPLICATIONS OF KIRLIAN PHOTOGRAPHY

This photographic technique promises useful application in biology, physiology, metallography and other branches of sciences. For example, this technique has been applied for the study of physiological conditions



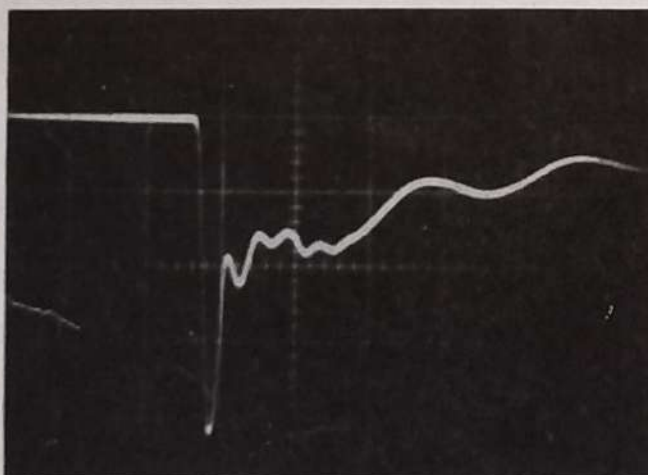
Scale: x; time — 5 μ s/div
y; voltage — 10 kV/div

Fig 5(a) Train of high voltage pulses used for Kirlian photography



Scale: x; time — 50 μ s/div
y; voltage — 10 kV/div

Fig 5(b) Expanded view of a single pulse of Fig 5(a)



Scale: x; time — 10 μ s/div
y; voltage — 10 kV/div

Fig 5(c) Rectified negative going unipolar pulse of Fig 5(b)

of various biological specimens, determination of cellular co-ordination in a living tissue of plant or animal and also for medical diagnosis. It has been reported that Kirlian photography has been successfully used in detection of cancer in a very early stage when conventional methods of cancer detection would not give any information of the disease. Also this technique



Fig 6 Phantom leaf in colour. Area of the cut portion shown between the dark straight lines



Fig 7 Phantom leaf effect in colour. Area of the cut portion shown between dark straightlines

has been used in the study of subtle mental and psychological changes in different human subjects. Furthermore it has very useful applications in forensic sciences.

Proper scientific investigation in Kirlian photography is of recent origin. But the multidimensional success of the technique demonstrates that it could prove a pathbreaking tool for scientific and medical applications in future.

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