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PHOTOELECTRIC PHOTOMETRY OF TEMPORARILY LUMINOUS BODIES

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[Note: Numbers in parentheses refer to the bibliography. All figures are appended.]

Some of the temporarily luminous bodies produced at present have very lasting phosphorescence, the intensity of which, during the process of extinction, is measured within the limits of 5 to 6.

Determining the nature of the extinction of temporarily luminous bodies is itself an important problem from both the theoretical and practical standpoints. At present it is generally determined by visual photometry (1). This method has serious defects, chief among which are the impossibility of recording the initial stages, the subjectivity of results obtained, and the rather great difficulties in making measurements. It is possible to eliminate these defects to a great extent by applying photoelectric methods of photometry.

In view of the wide range of the intensities measured, photoelectric apparatus for measuring intensity of temporarily luminous bodies can be built to utilize both photoelements and photomultipliers (2). The use of a photomultiplier permits measuring more remote stages of extinction.

If duration of the extinguishing operation under study is limited to a period of 0.5 to 1.0 hour, it is possible to assume that the brightness of the temporarily luminous bodies is measured in the range of 3×10^{-3} to 3×10^{-8} stilb (or, respectively, from 10^2 to 10^{-3} asb) ["stilb" is a Russian standard unit of light intensity; "asb" is absolute stilb]. The automatic elimination we obtained of the extinction curves in temporarily luminous bodies was based on the use of linear intensity and time scales.

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As a photometer, we made use of a previously constructed photoelectric photometer for measuring very weak light, based on the application of secondary electron amplification (3), in which a dubetskiy tube was used as a photomultiplier (4).

The photometer under study originally had a limited measuring range, and the measurements themselves were made with considerable lag brought about by the necessity of limiting the spectrum fluctuations. The specific conditions of our problem demanded introducing, into the circuit of the photometer, changes which would permit making measurements over a wide range of intensities, provided that there were no lags superimposed on the photometer.

A circuit was designed for measuring a wide range of intensities. By changing the magnitude of input resistance it was possible to obtain a direct current amplifier with amplification factors of 10^2, 10^3, 10^4, and 10^5.

Kron (5) arrived at a similar solution in studying the problem of measuring the brightness of stars which differed in magnitude.

The presence of the grid current Ic, and of the residual current I_{TO}, resulting from insufficient cooling, brought about the elimination of the temporary zero point in passing from one amplification factor to another. As a result of compensating the currents Ic and I_{TO}, a zero point was obtained on all scales.

To decrease the effect of temperature fluctuations resulting from cooling the photomultiplier by liquid air and heating it with a quartz lamp, all input and compensating resistances were isolated in a separate measuring block connected to the input of the amplifier by a shielded conductor having high-quality insulation.

A diagram of the photometer with the measuring block is shown in Figure 1.

Measurement of the initial stages of extinction is extremely difficult. Measurement is limited by both the inertia of the photometer circuit and the inertia of the output of the measuring instrument.

When the input capacity of the amplifier is less than 100 mmF, due to the use of input resistances of 10^6 and 10^7 ohms, the time constant of the amplifier in measuring the initial stages of extinction was reduced to less than 10^{-4} to 10^{-3} seconds. Hence, measurement of the initial stages of extinction is limited by the time constant of a galvanometer for short periods consisting of 3×10^{-2} seconds, as a result of which the inertia of the galvanometer does not operate until after 0.1 to 0.2 seconds.

A record of the amplified photocurrent was made by means of a photoreceptive galvanometer. The optical system of the recording galvanometer was similar to the optical system of a electromagnetic oscillograph (6).

To obtain time scales varying in magnitude, a drum with photosensitive paper was rotated alternately by one of three synchronized Warren motors. As a result, the following time scales were obtained: 1 mm - 0.006 seconds; 1 mm - 0.18 seconds; 1 mm - 8.8 seconds.

Excitation of luminous bodies was carried out according to the diagram in Figure 2. The long-wave ultraviolet radiation λ = 3650Å of the quartz lamp 1 passes through the "vudov" filter 3 and the diaphragms 2 and 4; after being reflected by the mirror surface 5, strikes through the aperture 6 in the box onto the luminous body 7 under examination. The light flux radiated by the luminous body in the visible part of the light spectrum passes through the objective 8, the filter 9, and the diaphragm 10, and is focused in the form of a small spot on the photocathode 11 of the photoamplifier. On the outside, the luminous body was screened by a light-proof covering, 12 on the box. Excitation was stopped by switching off the quartz lamp.

Particular attention was paid to the determination of the linear luminosity characteristic of the photometer represented by Figure 3.

Analysis of the problem showed that considerable lack of equilibrium in the bridge and sharp changes in the lamp intensity might be the main causes of the nonlinearity. When the limit of the input voltage of the amplifier is 0.5 V, nonlinearities, brought about by the above-mentioned factors, are reciprocally compensated. Photometry of permanently luminous bodies establishes the linearity of the luminous property in every measured interval, i.e., from 0.002 to 4.0 asb.

Figure 4 gives comparative results of visual and photoelectric photometry. It follows from Figure 4 that, while the data from visual photometry give a considerable number of points at the beginning and end of the recorded curve, photoelectric photometry gives a good layout of points on the curve and even makes it possible to measure the extinction within the initial 0.1 to 0.2 seconds.

Figure 5 gives an example of a photo-recording of the extinction of a luminous body.

The results obtained from the photo-recording of a photometer provide a basis for asserting that the photoelectric photometer under discussion permits obtaining much more exact and complete data on the path of extinction curves for temporarily luminous bodies compared with the data obtained from visual photometry.

BIBLIOGRAPHY

(1) Fridman, S. A., and Cherepnev, A. A., "Permanently and Temporarily Luminous Bodies," Izd AN USSR, 1945.
(2) Ellickson, R. T., J Opt Soc, Amer. 36,5, 264, 1946.
(3) Chechik, N. O., DAN USSR, 56, 2, 157, 1947.
(4) Kubetskiy, L. A., Izv AN USSR, Ser Fiz, 8, 6, 337, 1944.
(5) Kron, G. E., Astrophysical Journ, 103, 3, 326, 1946.
(6) Kasatkin, A. S., "Electrical Measurements," Gosenergoizdat, 1946.

[Appended figures follow.]

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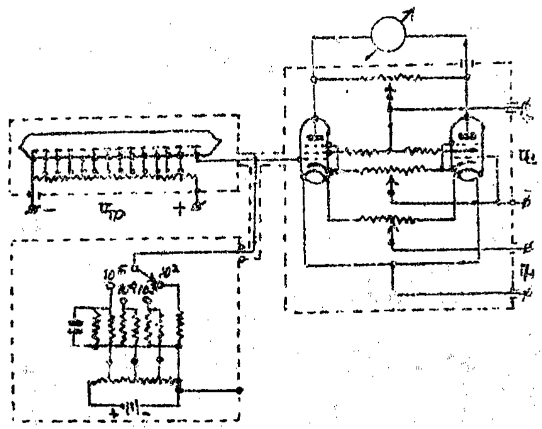

Figure 1

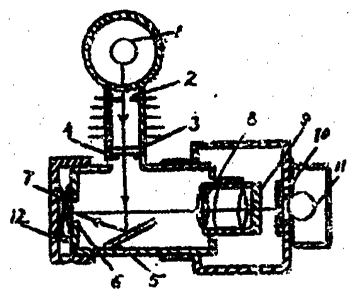

Figure 2

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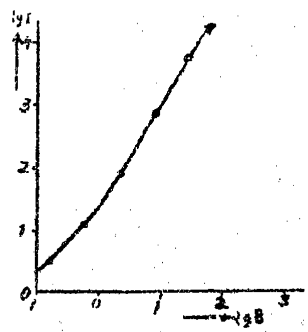

Figure 3

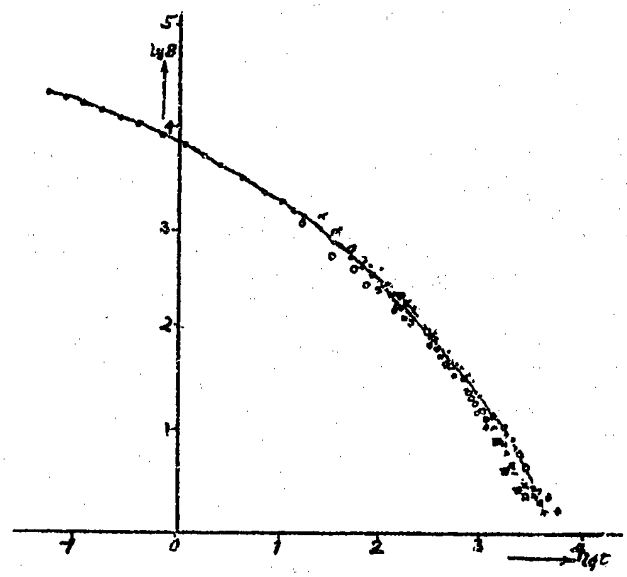

Figure 4

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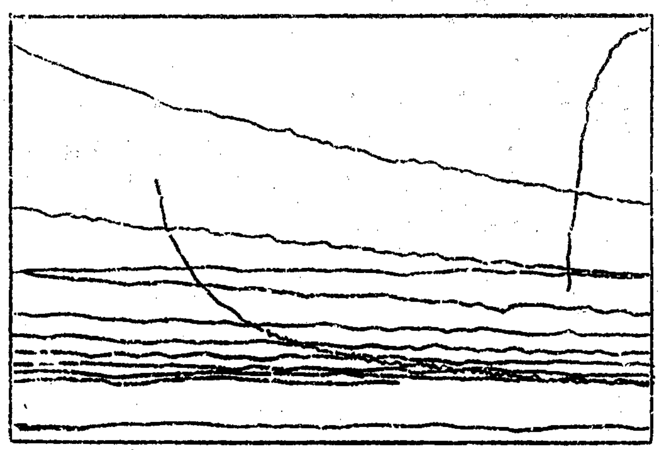

Figure 5

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