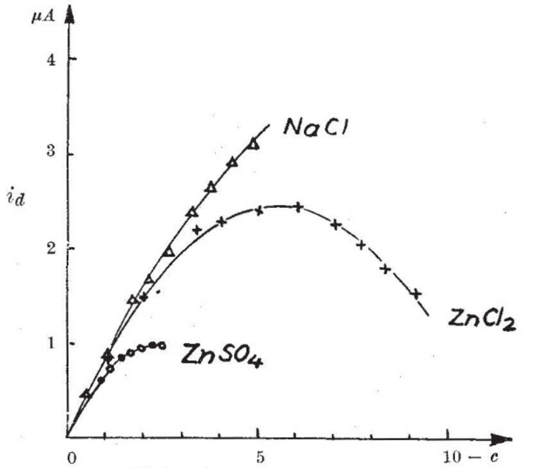

FIG. 2. Cd^{2+} IN VARIOUS SUPPORTING ELECTROLYTES (x/c IS CONSTANT)

(2) In the second series the diffusion current was found to be a parabolic function of c in solutions where (3) is valid (Fig. 2).

The Ilkovic equation may now be written :

$$i_d = \text{const. } D^{1/2}.x \quad . \quad . \quad . \quad (5)$$

Substituting $x/c = p$ and (4) in (5) we obtain

$$i_d = \text{const. } (-\ a.c + b).c.p \quad . \quad . \quad (6)$$

This equation shows that i_d has a maximum at $c = b/a$. In order to obtain the greatest possible accuracy in determining traces of impurities in a product, when the product itself serves as the supporting electrolyte, this concentration $c = b/a$ should be the optimal. However, it is not always possible to reach this optimal concentration, since the solubility of the supporting electrolyte is limited.

An investigation of Cd in $ZnCl_2$ did not show any change in optimal concentration with temperature (25, 50, 75° C.).

From the above it may be concluded that it is necessary to keep c absolutely constant when carrying out polarographic determinations in supporting electrolytes of high concentration. Another possibility is to work with methods allowing for variations in the nature and concentration of the supporting electrolyte, for example, Forche's[3] pilot ion technique.

A fuller account of this investigation will be published elsewhere.

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Aug. 24.

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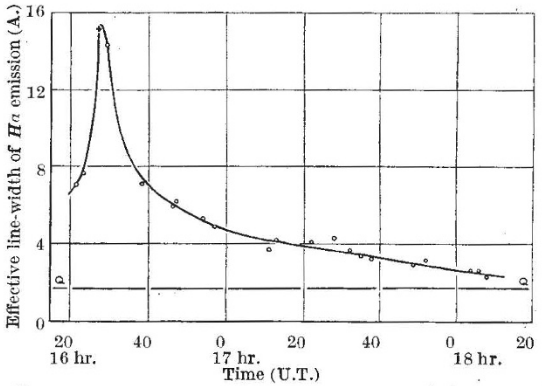
Spectrographic Observations of the Solar Flare of July 25, 1946

THE course of this flare was fully observed at Sherborne between 16h. 15m. and 18h. 10m. with the combined spectrohelioscope and spectrograph[1].

Measures of effective line-width, made with the spectrohelioscope line-shifter upon the brilliant reversal of the $H\alpha$ (λ 6563) contour, establish that the peak intensity of the flare radiation occurred at 16h. 27m. ± 1m. The shape of this curve, illustrating the variation of line-width against time, confirms previous results[2] obtained here by indicating the occurrence of what can be most appropriately described as a *radiation burst*, lasting for two or three minutes, at the commencement of a great flare. The subsequent history was one of slow decay over a period of about two hours.

Seven spectra (λ 4750–λ 6800), in the first and second orders of the 13-ft. spectrograph, were obtained between 16h. 25m. and 17h. 15m. One of these, taken at 16h. 27m., being closely coincident with the peak of flare intensity, is of special interest. The principal features are : (1) the brilliant reversal of the $H\alpha$-line, at least 15 A. wide ; (2) strong emission of helium, λ 6678, and reversals of two silicon lines, $\lambda\lambda$ 6347·1, 6371·4 ; (3) a narrow bright streak, representing enhancement of the continuous spectrum, commencing at about λ 6450 and gradually increasing in intensity towards shorter wave-lengths. A plate of the D-region of the spectrum, taken at 16h. 35m., shows helium D_3 (λ 5876) in emission over the flare filament and in absorption over the penumbra of the sunspot. On the other hand, the sodium lines, D_1 and D_2, reported as seen in reversal during previous flares, were not appreciably affected at this time.

From the appearance of helium λ 6678 (2^1P–3^1D) in emission, we can infer the existence in the flare radiation of λ 584 (1^1S–2^1P), with its powerful influence upon atmospheric ionization. Allen has previously reported[3] an observation of this line in emission, but Richardson and Minkowski[4] were unable to detect it in any flares seen upon the disk.



O, VISUAL MEASURES WITH SPECTROHELIOSCOPE ; + (NEAR PEAK). MEASURED FROM SPECTRUM PLATE AT 16 HR. 27 MIN. QQ, LINE-WIDTH OF QUIESCENT BRIGHT HYDROGEN.

Former flares have been recorded by monochromatic light, usually of the $H\alpha$-line. The sole exception was the phenomenon of September 1, 1859, which, by reason of its characteristic geomagnetic effects, was recognized by H. W. Newton[5] as the earliest, and possibly the greatest, of recorded flares. This became visible for a few minutes in integrated light and was seen independently by Carrington and Hodgson as a pair of brilliant patches over the giant sunspot, both observers using ordinary telescopic means. The enhancement of the continuous spectrum may be taken to represent the occurrence of a similar phenomenon on July 25, 1946.

Comparisons of the spectra taken before and after the peak intensity of 16h. 27m. lead to the conclusion that most of the characteristic features referred to are confined to the very short period of the radiation burst. It is also to be expected that the maxima of those immediate geophysical effects of a great flare (magnetic 'crochet' and radio fade-out) will be found to coincide in time with this flash of radiation.

A more detailed examination of the spectra will be published later.

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Aug. 12.

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[3] Allen, C. W., *Mon. Not. Roy. Ast. Soc.*, **100**, 635 (1940).

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Interpretation of the Meson Spectrum Near Sea-Level

THE spectrum of the mesons near their place of production can be deduced from the spectrum observed near sea-level. The probability of a meson reaching sea-level with a final momentum p is, according to Euler and Heisenberg[1], given as follows :

$$P_{p_1}(p) = \left\{ \frac{q}{p_1} \left(1 + \frac{q - p_1}{p} \right) \right\}^{-\frac{p_\tau}{p+q}}. \qquad (1)$$

All quantities have been expressed in terms of momenta, the symbols having the following meaning :

q = 2,000 Mev./c., the momentum loss on traversing the atmosphere.

p_1 = 200 Mev./c., the momentum loss on traversing the atmosphere lying above the meson-producing layer.

$p_\tau = \mu c \dfrac{H}{c\tau}$ = 1,270 Mev./c., with H the height of the homogeneous atmosphere, τ the average life of the meson, μ mass of the meson.

Equation (1) is based on the assumption that all mesons are formed at the same height. We have investigated the alternative assumption that the mesons are formed by primaries which are absorbed exponentially in the atmosphere, thus giving rise to an extended production layer. The average probability of a meson formed in this layer reaching sea-level with a final momentum p is thus

$$\bar{P}_{p_1}(p) = \int_0^q e^{-p^1/p} P_{p^1}(p) \frac{dp^1}{p_1}. \quad . \quad (2)$$

We find that the integral (2) is in good approximation given by

$$\bar{P}_{p_1}(p) \approx \left(\frac{p_\tau}{p+q} \right)!\ P_{p_1}(p). \quad . \quad . \quad (3)$$

The factorial appearing in (3) always has numerical values between 0·9 and 1·0. Thus the difference between $\bar{P}$ and P is unimportant and the expression (1) can be assumed to refer to an extended layer as well as to a single layer of production.

The differential meson spectrum at sea-level, S, can be expressed in terms of S_0, the spectrum at production, in the following way

$$S(p) = S_0(p + q - p_1)\ P_{p_1}(p), \quad . \quad . \quad (4)$$

except for the very small range, irrelevant for our purpose, in which increased ionization takes place at sea-level.

Using the experimentally observed spectrum given in a preceding letter[2], and assuming that