that in this particular flare the widths of $H\alpha$ and $H\beta$ in emission were, in fact, 8 A. and 6 A. respectively during the maximum phase. These widths are clearly inconsistent, even qualitatively, with the Stark effect hypothesis of line-broadening in flare spectra ; but in this particular instance neither does the Zeeman effect fare any better quantitatively as a rival hypothesis. Incidentally, it will be noticed that the above widths are consistent with what is to be expected on the basis of the Doppler effect, although there are certain difficulties in unreservedly admitting this hypothesis without qualification also ; in any event, with the meagre observational data so far available, it does not seem justifiable to rule out completely the Doppler effect as a possible major factor.

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[1] *Nature*, **164**, 280 (1949).

Those who are interested in the flare problem will welcome observations of the kind referred to in the preceding letter. At the same time, I cannot agree with Dr. Das and his colleagues in their facile conclusion that the measured line-widths of 8 A. and 6 A. for $H\alpha$ and $H\beta$ in emission "are clearly inconsistent, even qualitatively, with the Stark effect hypothesis of line-broadening in flare spectra". After all, these measures merely confirm my own observations, to which both Mr. C. E. R. Bruce and the present writers have referred. For the following reasons it seems improbable that this issue can be decided by line-width measures alone.

We must recollect that flare emission lines are normally observed and photographed in association with the Fraunhofer spectrum of the reversing layer : in the case of hydrogen, therefore, each line is a complex blend of an emission line superimposed upon the absorption profile of the corresponding Fraunhofer line. There is also a good deal of evidence that the emission lines originate, in general, at a level somewhat above that of the reversing layer. The line-width measured at Kodaikanal is therefore what I have called the "effective line-width", as measured between the "extinction points"[1], where the emission profile blends into the wings of the absorption line on the two sides of the line centre. It is by no means certain that this is the same thing as a measure of the total width of the emission line as it would appear if it were freed from blending with the Fraunhofer spectrum. Only on the rare occasions when an intense flare is seen at the sun's limb and detached from the chromosphere can these ideal conditions be realized.

Furthermore, the emission lines decrease in central intensity and the absorption lines decrease in breadth as we pass from $H\alpha$ to the higher members of the series. In these circumstances we should scarcely expect the Stark effect to manifest itself in accordance with the idealized hydrogen patterns for uniform field, such as we find in text-book illustrations. That is to say, we should not look for a progressive widening of the emission wings in the direction $H\alpha$, $H\beta$, etc. There will almost certainly be a blending and a blurring of the transverse and longitudinal Stark components, corresponding to a wide range of field-strengths, and these wings will be combined in the same profile with a strong central core of the unresolved line. Taking these various factors into account, I should say it is by no means clear that the observed values are necessarily inconsistent with the operation of the Stark effect. We need some information on the line profiles and degree of polarization as well.

I may add that the evidence favourable to the Stark mechanism and contrary to the theory of thermal Doppler broadening has been given elsewhere[2]. Briefly stated, there are strong grounds for assuming that there is a sufficiently high concentration of electrons in the flare region for the Stark effect to operate. On the other hand, thermal Doppler broadening would require a temperature of the order 10^6 degrees K. to explain the great line-widths which have been repeatedly photographed and measured[3] ; but the flare spectrum is essentially one of low temperature. The matter has been reviewed by F. Hoyle in his book "Some Recent Researches in Solar Physics" (p. 93).

In conclusion, it seems unlikely that we shall be able to shed more light upon this issue until we are in possession of calibrated plates showing a considerable portion of the Balmer series in emission during the 'flash' phase of an intense flare. It will then be possible to examine not merely the widths but also, and more important still, the intensity profiles of the lines. Anyone who can secure such results from a major flare at the sun's limb is assured of a rich reward for his preparedness.

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[1] Ellison, M. A., *Mon. Not. Roy. Astro. Soc.*, **103**, 3 (1943).
[2] Ellison, M. A., and Hoyle, F., *The Observatory*, **67**, 181 (1947).
[3] Ellison, M. A., *Mon. Not. Roy. Astro. Soc.*, **109**, 3 (1949).

A Simple Device for Recording Mean Temperatures in Confined Spaces

For many ecological and phenological purposes, records of maximum, minimum and mean temperatures are required, while in physiological studies of metabolic-rates only the last-named may be necessary; but in both cases measurements must frequently be made in very confined spaces. Apart from expensive thermocouple amplifiers with their considerable power demands, existing temperature-recording methods are unsuitable for two reasons : the normal thermograph has a sensitive element which is much too large in relation to the spaces of which the temperature is to be measured, quite apart from measuring temperature gradients within such spaces; and, secondly, the process of 'integrating' the curve of a thermograph chart is time-consuming and often inaccurate. My ecological studies require a knowledge of the mean temperature at which soil animals are living, so that laboratory measurements of metabolic-rate may be extended to field conditions ; temperatures have therefore to be measured at a number of depths in the soil. At the same time it is desirable for this particular purpose that the values obtained should be related to the temperature not on a linear scale, but in approximately the same way as metabolic-rates are related to temperature, namely, logarithmically, so that a 10° C. increase in temperature has double the effect on the final value, while a 10° C. decrease in temperature