Reprinted from *The Observatory*, Vol. **79**, No. 913, pp. 210–211

Reprint No: 1

The Flare of 1957 September 19

By R. Jayanthan

Kodiakanal Observatory

A flare of importance 2 associated with a large spot-group (Kodaikanal No. 10661) was observed with the spectrohelioscope of this observatory on 1957 September 19. The flare (coordinates of flare 22° N., 6° E.) began at 0405 hrs. U.T., reached the maximum at 0410 hrs. U.T. and faded away at 0432 hrs. U.T. This flare was also associated with a geomagnetic storm[1] of sudden commencement type which began at 1006 hrs. U.T. on 1957 September 21. As this flare occurred almost on the central meridian, changes caused by any expelled particles from the flare region on the structure of the emission lines in its spectrum can be studied with greater facility.

Spectra covering the whole region from $H\alpha$ to H and K with a single exposure were photographed with the camera attached to the spectrohelioscope at different times during the period of the flare activity.

The spectrum recorded at 0409 hrs. U.T.—a minute before flare maximum—shows the Balmer lines and the H and K lines in emission. All these lines are widened asymmetrically about the undisturbed positions of the photospheric lines, the widening being more towards the longer wavelength side. In the spectrum obtained at 0411 hrs. however, the lines are broadened almost symmetrically, asymmetry if any at all being insignificant.

Ellison[2, 3, 4] has considered two alternative mechanisms to explain the asymmetric widening of the $H\alpha$ line—an asymmetry in the wings of the line or a genuine displacement of the emission line as a whole—and has rejected the latter hypothesis. He[5] however "does not altogether exclude the possibility that in exceptional cases genuine flare emission may be observed in rapid motion ($\sim$ 100 km/sec)."

From micrometer measurements and microdensitometer records in the $H\alpha$ region of the present flare spectrum, it is found that the geometrical centre and also the position of maximum intensity of the emission line are shifted towards the red, by the same amount. This result is confirmed by the $H\beta$ and $H\gamma$ lines. So in the present instance, at any rate, the asymmetric widening of the lines cannot be due to absorption in the violet wings. The observed features can be better interpreted as being caused by genuine displacements of the emission lines towards the red. The velocity of recession derived from the measurements is $\sim$ 30 km/sec. The widths of the emission lines $H\alpha$, $H\beta$ and $H\gamma$ measured from the photographed spectrum are 7·7 A, 4·5 A and 2·2 A respectively; this confirms earlier observations reported from this observatory of the decrease of line widths as one proceeds from $H\alpha$ towards the higher members of the Balmer series.[6]

In the past conclusions based on observations of the $H\alpha$ line alone have had to be modified in the light of the further evidence provided by the other Balmer lines. Extensive spectroscopic observations of flares in more than one line of hydrogen and preferably in lines of elements other than hydrogen are necessary for a correct interpretation of all the features observed in flares of different types.

I thank Dr. A. K. Das, Deputy Director-General of Observatories, Astrophysical Observatory, Kodaikanal for his interest in this work and for many valuable discussions.

References

(1) *Indian J. of Met. and Geophys.*, **9**, 85, 1958.
(2) M. A. Ellison, *M.N.R.A.S.*, **103**, 3, 1943.
(3) M. A. Ellison, *Pub. Roy. Obs., Edinburgh*, Vol. I, No. 5, 1952.
(4) M. A. Ellison, *M.N.R.A.S.*, **109**, 3, 1949.
(5) M. A. Ellison, *The Observatory*, **68**, 71, 1948.
(6) A. K. Das, *et al.*, *Nature*, **164**, 964, 1949; *Indian J. Met. and Geophys.*, **8**, 7, 1957.

Printed by The Vincent-Baxter Press, Oxford