9. THE NEW FLARE SPECTROGRAPH AT ONDREJOV

ZD. SVESTKA

We present here several examples of flare spectra obtained by the new flare spectrograph built at Ondrejov, Czechoslovakia. The spectrograph, finished in May of this year, works in five spectral regions, Hα, $D_{1\ 2\ 3}$, Hβ, Hγ, and H and K, taking simultaneously broad surroundings of these lines on five plates, with a dispersion of 1 Å/mm. The focal length of our objective mirror is 14·5 m, the size of the grating is 9 × 10 cm. We get our spectra in the second order of the grating; the first order is used for guiding in the Hα line. The plates are calibrated by means of a scale, which is placed on the slit and illuminated by the centre of the solar disk.

We show here (not reproduced) one set of plates containing successive spectra—at 1^{m} intervals—of the great flare of 1958 July 20. These spectra cover the whole development of the flare, almost from its first appearance on the disk, so that we may follow here the pre-maximum, maximum, as well as the post-maximum phase. Further we present several other flare spectra, which are of some interest as to the asymmetry of the emission lines, their distortions, or a great number of reversals in the metallic lines.

10. EJECTIONS DE MATIÈRE ABSORBANTE AU COURS D'ÉRUPTIONS CHROMOSPHÉRIQUES

Mme M. D'AZAMBUJA

Les enregistrements cinématographiques de la chromosphère solaire, à l'aide de l'héliographe automatique de Meudon, ont permis de constater par trois fois, au début d'éruptions chromosphériques importantes, des éjections de matière absorbante se déplaçant sur des distances pouvant aller jusqu'à un rayon solaire, durant un intervalle de temps de l'ordre d'un quart d'heure. Cette absorption a été simultanément relevée sur des spectrohéliogrammes K_1, à 1·2 ångström du milieu de la raie. On peut se demander si elle ne correspondrait pas aux émissions corpusculaires prévues par la théorie de Chapman et que les contours de raies au microphotomètre n'ont pu jusqu'ici mettre en évidence avec certitude.

11. BALMER SERIES LINES IN FLARE SPECTRA

Z. SUEMOTO AND E. HIEI

Many spectra of flares have been taken at the Tokyo Astronomical Observatory with a newly-built wide-range spectrograph. On this instrument the spectrum covering the whole Balmer series lines and continuum can be recorded with a dispersion of about 3·2 Å/mm on commercial 35 mm film of about 150 cm in length by a single exposure. So far we have measured Balmer series lines for only four flare spectra of flares of importance 2. But the results obtained appear to us remarkable.

Profiles of flare spectra were compared with the profiles of normal spectra in the neighbourhood of flares and suitable corrections were made to obtain a 'reduced profile' for the flare spectrum.

When the total half-widths of the 'reduced profiles' of the Balmer series lines are plotted against their principal quantum number n, the half-widths show a minimum at about $n=8$, and the whole plots are best fitted by a theoretical curve with the following values: $T_e=15{,}000°$, $n_2H^*=8\times10^{14}\ \mathrm{cm}^{-2}$ and $n_e=10^{13}\ \mathrm{cm}^{-3}$. H^* is the effective thickness of the flare layer.

If we take $T_{exc}=5600°$ for the relative population between $n=2$ and $n=8$, which is estimated from the saturated central intensities of the earlier members, we find $n_8H^*=$

https://doi.org/10.1017/S0251107X00030194 Published online by Cambridge University Press

2×10^{13} cm^{-2}. Assuming H^* to be 10^8 cm, the scale height of the chromosphere, we get $n_8 \approx 2 \times 10^5$ cm^{-3}, and hence $n_e n_i / n_8 \approx 5 \times 10^{20}$. However, for a wide range of temperature, i.e. for $T = 5000°$ and $15,000°$, we have $n_e n_i / n_8 = 8 \times 10^{18}$ and 6×10^{19}. On the average there is a discrepancy of the order of 1/20.

In order that this ratio should take plausible values, one would have to assume a very small thickness for the flare of the order of 50 km, 1/20 the scale height of the chromosphere.

The only plausible interpretation, it appears to us, is that the flare consists of a great many very thin thread-like condensations, i.e. lightnings, presumably distributed over the whole extension of the chromosphere.

12. ON THE NATURE OF FINE STRUCTURE OF ACTIVE REGIONS ON THE SUN

I. S. SHKLOVSKY

The author has recently considered theoretically the problem of moustaches, the phenomenon investigated by Severny [1, 2]. The phenomenon indicates the motion of emitting hydrogen atoms with velocities 500–1000 km/sec. If the lifetime of moustaches is of the order 100 sec, the emitting matter must reappear 10^3 times during the lifetime of this formation.

Considerations of possible sources of excitation have led the author to the following conclusions. If in some active region (of the size of 100 km) separate small portions or 'knots' of rapidly moving matter are formed, these 'knots' interact with photospheric plasma. The interaction consists of inelastic collision between H-atoms and some shock-front phenomena. These phenomena resemble the mechanism of excitation of H-atoms in aurorae [3, 4]. The main source of excitation in moustaches is connected with the transfer of excitation from excited H-atoms of these rapidly moving knots to the same atoms of photospheric plasma. The 'quantum output' for this process may reach 5 photons per rapidly moving H-atom. This permits us to evaluate the total number of Hα-quanta emitted by an active region during a moustache lifetime and also the total mass of a 'knot'. This mass is about 10^{13} g, that is, $\sim 3 \times 10^{-4}$ of the total mass of the active region in the photosphere. The total energy of the knots is 10^{28} ergs and it is of the same order as the magnetic energy of the active regions, which is the most probable source of the energy of moustaches. The instability of plasma in magnetic fields may be considered as a probable source of the phenomenon of moustaches, which is in some respects quite similar to the phenomenon of plasmons.

The wide spread of velocities (10^8 cm/sec) in small regions of the chromosphere (10^8 cm) may also produce favourable conditions for the acceleration of particles up to relativistic energies by means of some kind of statistical mechanism of the Fermi type. The possibility of that process in the photosphere is ruled out owing to very high ionization losses.

REFERENCES

[1] Severny, A. B. *Publ. Crim. astrophys. Obs.* **17**, 199, 1957.
[2] Severny, A. B. *Astr. J., Moscow*, **34**, 482, 1957.
[3] Shklovsky, I. S. *C.R. Acad. Sci. U.R.S.S.* **81**, 367, 1951.
[4] Chamberlain, J. *Ap. J.* **120**, 360, 566, 1954.