ON THE EMISSION SPECTRA OF MOUSTACHES

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1. Introduction

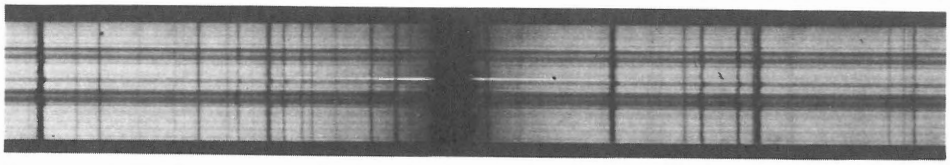
It is well known that mass mations are frequently observed around moustache points. Severny (1968), from the study of the " Fraunhofer lines kink ", reported the upward velocity field of 1-3 km/s at the upper photospheric levels. Roy and Leparskas (1973) observed a close spatial correlation between the moustaches and the fast moving ($\simeq$100 km/s) dark oblong features and suggested that these dark features were ejected matter from the moustache points.

In this work, it is shown that we can deduce the chromospheric velocity fields in moustache points from the emission profiles of moustaches. From our preliminary analysis of some moustache spectra, we have found that matters in moustache moves up- or downwards with velocities of about 10 km/s at the chromospheric levels.

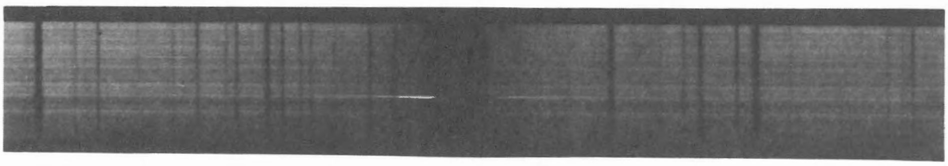
2. Observation

We have analysed an echelle spectrogram and some grating spectrograms of Hα and Hβ lines.

FIGURE 1. Hα spectra of moustaches



(a)



(b)

The echelle spectrogram was taken at Okayama Astrophysical Observatory on August 15,1979. The moustache point was situated near the east limb, r = 0.95. Characteristic emissions were detected in the Balmer lines of Hydrogen and H and K lines of Ca II ion. The spatial resolution of the spectrogram was about 3".

The other grating spectrograms were taken through the Horizontal Spectrograph of the DST at the Hida Observatory on May 23, 1980. Thanks to the good seeing conditions, we have obtained the sharp spectra with spatial resolutions of 1-2". Some examples are shown in Figure 1.

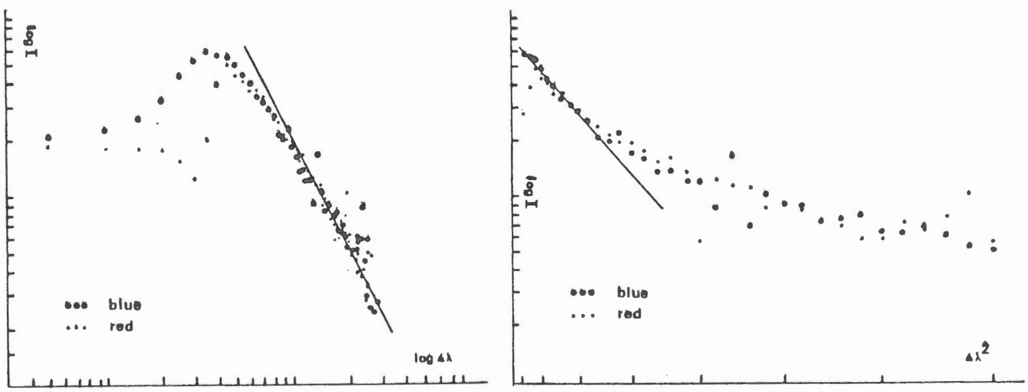
Emission spectra were obtained by subtracting the spectra of neighbouring normal regions from the moustache point spectra.

3. Emission Profiles of H_α and H_β lines

a) Central absorptions due to overlying matters

The emission profiles of moustaches have central absorptions, and the intensities of two peaks are generally different. Blue asymmetry in the intensity peaks is known to be prevailing (Severny ; 1968). Statistical studies by Bruzek (1972) show a strong positive correlation between the blue shift of central absorptions and the red asymmetry of the intensity peaks. In our samples, the correlation is confirmed to exist. A clear example is shown in Figure 1 (b). The central part of the spectrum is absorbed by a red-shifted matter and the emission profile does show a blue asymmetry in the intensity peaks. Thus we can think that the central part of the emission spectra is absorbed by overlying matters and the asymmetry is

FIGURE 2. Plot of a H_α emission profile



the result of the motion of the overlying matters. However, a sample profile shows blue asymmetry and a blue shift of the central absorption. This points will be considered in the next subsection.

b) Gaussian emission cores and power-law emission wings

As is shown in Figure 2, log $I(\Delta\lambda)$ vs. $\log\Delta\lambda$ plot and log $I(\Delta\lambda)$ vs. $(\Delta\lambda)^2$ plot diagrams indicate the decomposition of the emission profile into a core part and a power-law wings, where $\Delta\lambda$ is the wavelength difference from the line center that is determined with reference to some neighbouring weak Fraunhofer lines. A power-law wing is symmetrical referred to the line center and the index of the power is around 2. Core part of the spectrum can be considered to obey a Gaussian profile if the center of the core part is displaced from the line center.

For all the other samples, we can also decompose the emission profiles into two components if we take into accounts some Doppler shifts for the components. The magnitudes of the Doppler shifts for the two components of our samples are summarized in Table I. We can see that the Doppler shifts are generelly bluewards and the core parts show larger shifts ($\simeq$ 6 km/s). We propose here that these blue shifts of the core part,in addition to the motion of the overlying matters, can work to give rise to the blue asymmetry in the intensity peaks.

TABLE I.

Doppler-shifts of the core and wing parts of the H_α emissions for 6 moustaches. (unit : km/s)

	v(core)	v(wing)
1	- 5.8	- 0.3
2	- 0.2	0.0
3	- 5.9	- 2.0
4	?	- 5.6
5	?	+ 0.7
6	- 6.0	- 0.6

TABLE II.

Doppler-shifts and Doppler-widths of the emission cores in the Balmer and K lines. (unit : km/s)

line	v(shift)	v(width)
K	+ 8.2	67.7
H_α	+10.2	98.7
H_β	- 0.4	89.7
H_γ	+ 0.4	87.3
H_δ	- 0.9	73.2

For H_β lines, we have essentially the same results as for H_α lines.

4. The Doppler-shifts of the Emission cores of Balmer lines and K line

In the echelle spectrogram, moustache emissions can be seen in H_α, H_β, H_γ, H_δ and K lines. From the Gaussian fitting to the profiles, we have deduced Doppler-shifts of the emission cores. The results are shown in Table II. Strong H_α and K lines show large red shifts ($\simeq$10 km/s), although other Balmer lines show little motion. So in this case, matters in higher layers were down-falling but in lower layers matters were static.

5. Summary

a) Emission profiles of moustaches are composed of Doppler shifted Gaussian cores and slightly Dopplershifted symmetrical power-law wings with central absorptions due to overlying matters.

b) In upper layers, matters in moustaches move up- or down-wards about 10 km/s. On the other hand, in lower layers matters remain virtually static.

c) Upwards motions are prevailing in upper layers. This may be a factor that give rise to the blue asymmetry in the intensity peaks.

REFERENCES

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