57. Identification of the Telluric H₂O Lines in the Photographic Infrared Spectral Region of Carbon Stars^{*)}

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In the photographic infrared spectral region from around 7800Å to 8600Å it is well-known that the telluric H₂O lines are strong and sometimes blended with stellar lines which make the identification of stellar lines very difficult.

As the accurate estimation of the relative abundance of ¹²C to ¹³C by the CN Red System in carbon stars is theoretically interesting and important in the sense of nucleogenesis of carbon stars (Fujita and Tsuji (1977)), the blending of these telluric lines with stellar lines should be carefully investigated. For the purpose of getting to know the accurate locations of these lines in carbon stars, it became evident that the comparative study of the spectrum of μ Cep, a typical M-type star with carbon stars in the same spectral region is most efficient.

The spectrum of β Peg, another typical M-type star was carefully investigated by Davis (1947) sometime ago and its identification in a wide range of the spectral region was successfully carried out. Referring to Davis' Table of wavelength of β Peg, the identification of the spectrum of μ Cep is quite possible. It was shown that the microphotometric tracing of the spectral region from 7800Å to 8600Å clearly demonstrates the features of the telluric H₂O lines, some of which being blended with stellar lines.

As an example, the microphotometric scans of μ Cep by the PDS from 8200Å to 8300Å are shown in Figs. 1 and 2.

The predominance of telluric H₂O lines is well recognized demonstrating their sharp contours, though some of them might be blended with stellar lines. Therefore, it seems a good idea to compare the PDS scans of μ Cep with those of carbon stars by simple superpose. As an example, the identification of the spectrum of Y CVn (C5, 5J), a typical carbon star from 8200Å to 8300Å in the PDS scans is shown in Figs. 3 and 4.

By superposing these PDS scans on those of μ Cep, the locations of the telluric H₂O lines in Y CVn can be well discriminated. As

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Fig. 1

Fig. 2

Figs. 1–2. The PDS scans of μ Cep from 8200 Å to 8300 Å. All the telluric H_2O lines >10 mÅ in E. W. are indicated with P, Q, and R (rotation branch) followed by quantum numbers and E. W. in brackets. (Refer to Moore *et al.* (1966).)

Fig. 3

Fig. 4

Figs. 3–4. The PDS scans of Y CVn from 8200Å to 8300Å. Identified stellar lines are indicated with usual notations. Most of them are of CN Red System. Isotopic ¹³CN lines are indicated with i. The telluric H₂O lines which are free from stellar lines are indicated with P or Q and those blended with stellar lines are indicated with T. Observed red shift is +0.91Å.

Fig. 5

Fig. 6

Figs. 5-6. The PDS scans of Z Psc from 8200Å to 8300Å. Only the telluric H_2O lines which are free from stellar lines are indicated. Observed red shift is $+0.93\text{\AA}$.

are shown in Figs. 3 and 4, many stellar lines are supposed to be blended with the telluric H₂O lines. There are, however, some which are completely free from blending with the telluric H₂O lines.

It should be remarked that the relative positions of stellar lines to the telluric H₂O lines subject to change due to the amounts of line shifts by the radial velocity of each star. Another example of carbon stars Z Psc (C7, 2) is shown in Figs. 5 and 6.

In such a way, we could select the stellar CN lines which are free from blending with the telluric H₂O lines through the whole spectral region from 7800Å to 8600Å.

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References

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