A SURVEY OF THE YELLOW-RED INTERSTELLAR DIFFUSE SPECTRUM LINES

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1. THE SURVEY

A survey of about 100 lines of sight was made using the coudé auxiliary telescope and the coudé spectrograph of the Shane 3m telescope of the Lick Observatory. The data acquisition required 7 observing seasons. The spectra were recorded photographically at 17A°/mm using a Varo tube intensifier. Each plate was separately calibrated for intensity and wavelength. The plates were measured using the PDS microdensitometer of the Royal Greenwich Observatory, Herstmonceux, and that data reduced on STARLINK using procedures developed by D.W.T. Baines. Care was taken to treat all photographic material in a consistent manner throughout the duration of the survey. The reduced data may therefore be considered self-consistent. The emulsion types used were (principally) Kodak IIIaF and (more rarely) 103aD.

The lines at 5780, 5797, 6283, 6613A° were considered to be fairly free of contamination by weak stellar absorption lines. However, the diffuse line at 6283A° is heavily contaminated by an atmospheric oxygen band. P.C.T. Rees has developed a satisfactory method whereby most of that contamination can be removed revealing the diffuse line at 6283A° to be symmetrical with broad wings. During the reduction, the shapes of the lines are noted and in the case of the line at 6613A°, the central wavelength was determined.

The data from this survey will be published in detail elsewhere.

2. PRELIMINARY CONCLUSIONS

Previous surveys (e.g. Herbig 1975) have sought to establish broad behavioural trends for the diffuse interstellar lines. We will concentrate in this note on range of behaviour. The data is illustrated in Fig.2.1. The following preliminary conclusions can be drawn:

a. Equivalent width can vary by up to a factor of 3 for the same E_{B-V}.
b. E_{B-V} can range over a factor of 3 for the same equivalent width.
c. Equivalent widths can have a similar range (i.e. factors of 3) of behaviours between themselves.

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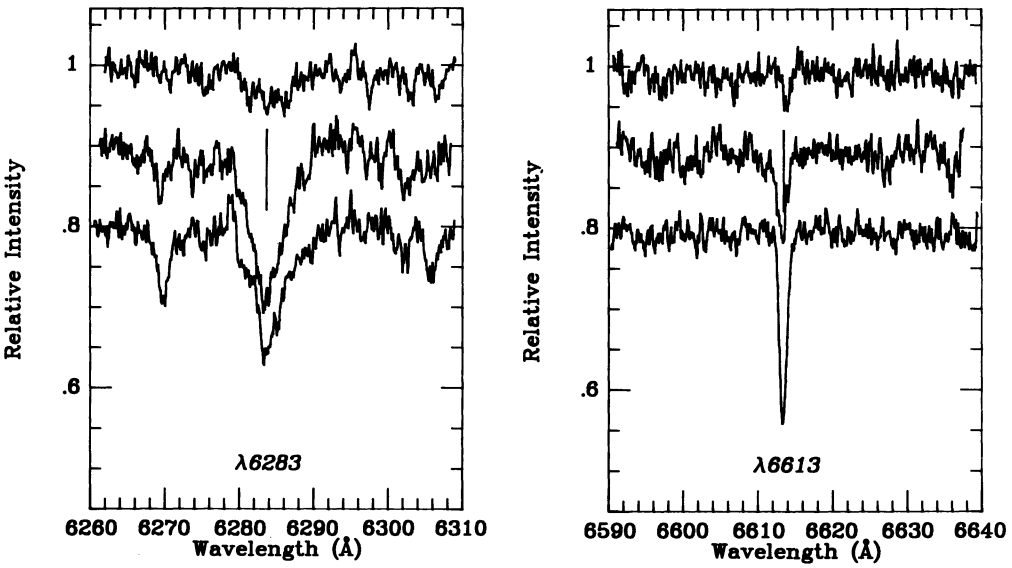

Diffuse interstellar line spectra at 6283 and 6613 A°. From top to bottom: HD 24534 E_{B-V} = 0.58), HD 4841 (E_{B-V} = 0.65), HD 187982/3 (E_{B-V} = 0.66). To separate the spectra, the relative intensities have been reduced by subtracting 0.1 and 0.2 from the two lower spectra respectively.

d. There is some evidence to suggest that lines of sight close together on the sky exhibit reduced ranges of behaviour.
Fig.2.1 exhibits the variation of equivalent width with E_{B-V}. In the case of HD 4841/187982 note reversal of the relative strength in the case of the diffuse lines at 6283 and 6613A°. The examples chosen do not represent extremes of observed behaviour.

There is a suggestion in the data that the diffuse interstellar absorption lines result from several distinct carriers. However, the transitions responsible seem sensitive to local interstellar conditions - once identified the diffuse lines would be useful diagnostics of interstellar conditions. The data is as yet insufficient to ascribe the carriers to the gaseous or the solid component of the interstellar medium - notwithstanding, we favour carriers in the gaseous component. More extensive conclusions must await the outcome of more detailed analyses.

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Reference Herbig, G.H., 1975, Astrophys.J. 196, 129.