INTERSTELLAR SODIUM AND GALACTIC STRUCTURE. A HIGH-RESOLUTION SURVEY

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INTRODUCTION

Observation of absorption lines produced by interstellar gas is a straight-forward way to determine column densities and velocities along the line of sight of interstellar clouds. In practice, peculiar motions often mask galactic rotation and/or cause line blending. We have made a study of absorption lines of interstellar sodium covering a substantial part of the Galaxy at extremely high spectral resolution.

OBSERVATIONS AND RESULTS

We used the ESO Coudé Echelle Spectrometer with the 1.42-m Coudé Auxiliary Telescope and a Reticon silicon photodiode array. The resolution is 10^5 or 3 kms^{-1} at 5893 Å. At V=8 a s/n ratio of 150 is reached in 3 hours. We have made over 200 observations of 150 early-type stars with V from 0 to 9. We include also stars far from the galactic plane.

Almost all our stars have lines of interstellar NaI, also the very brightest ones. Less than 15% of the stars have spectra with less than two components, whereas close to 30% display 5 or more components. The presence of the two NaI D lines makes identifications rather clear-cut. Major features of interstellar sodium can be traced over large parts of the Galaxy. However, star-to-star variations are pronounced, also over small angular distances. It concerns line positions as well as equivalent widths. Some stars which are apparently close in space present line patterns of interstellar sodium which are rather difficult to match.

INTERSTELLAR SODIUM IN THE DIRECTION OF SCORPIUS OB 1

As an example we show in Figure 1 spectrograms of four supergiants in Sco OB 1. The strength and complexity of interstellar sodium may be compared to the fairly modest reddening (Schild et al., 1971). The largest sodium feature is similar for all four stars, with a "red" wing

H. van Woerden et al. (eds.), The Milky Way Galaxy, 325–327.

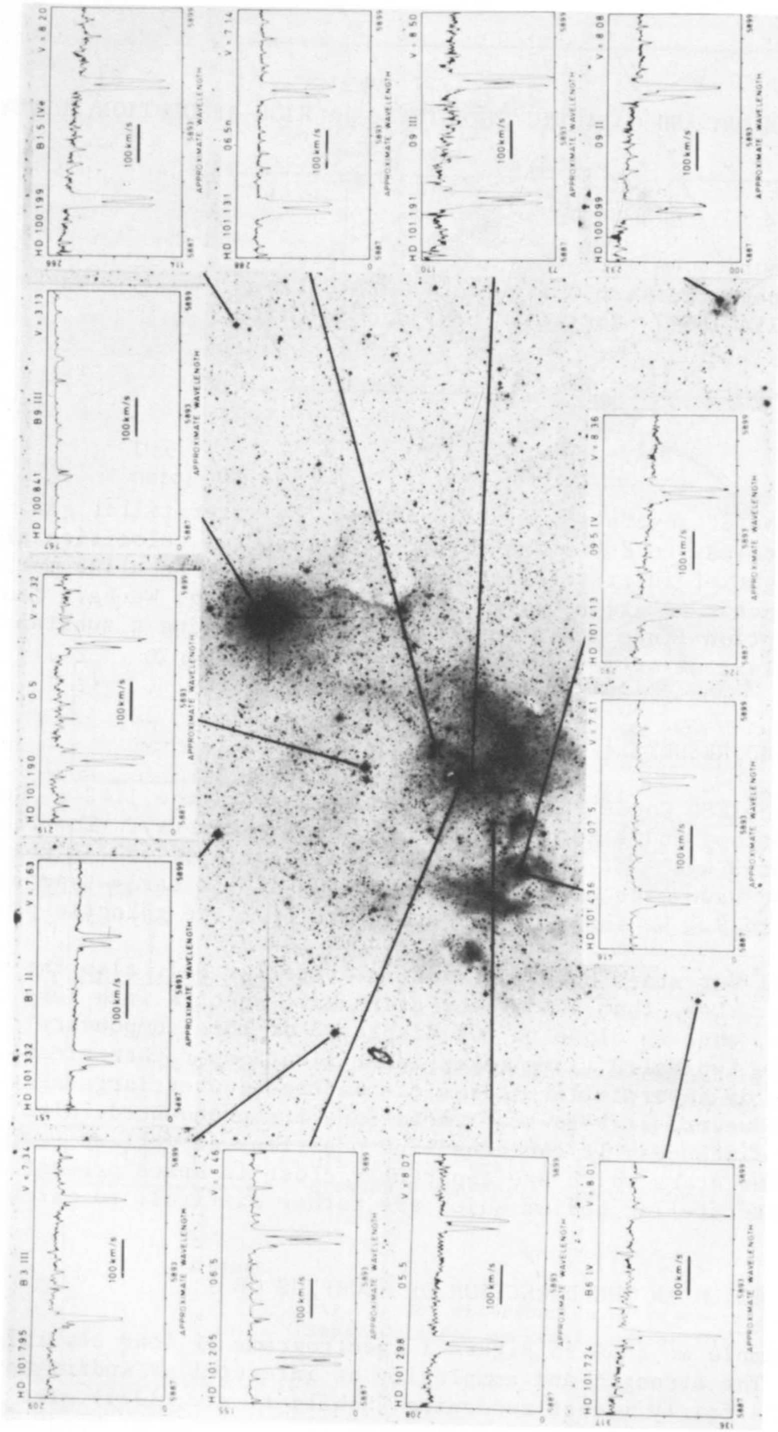

Fig. 2. Interstellar sodium in the direction of the Carina spiral arm

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corresponding to velocities close to that of the Sun. Therefore, the major contribution seems to come from interstellar sodium close to the local spiral arm. The behaviour of the line components at "negative" radial velocities varies notably, as it does for the "blue" wing of the principal line feature. Preliminary estimates show the "blue" line components to fall between -25 and -55 kms^{-1} (LSR). These radial velocities are much more negative than expected from rotation models (Schmidt, 1965; Georgelin and Georgelin, 1976). At a much lower resolution, Rickard (1974) found the same effects for interstellar CaII.

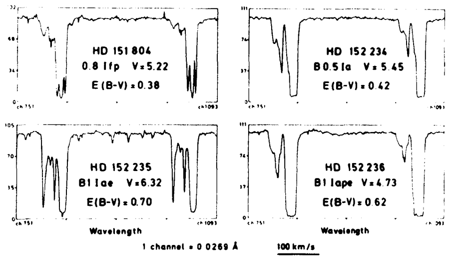

Fig. 1. Interstellar sodium in front of Scorpius OB 1

INTERSTELLAR SODIUM ALONG THE INNER SIDE OF THE CARINA SPIRAL FEATURE

A detailed study of interstellar sodium along the inner side of the Carina spiral feature covers a distance interval of four kpc with E(B-V) up to 0.38 (Ardeberg and Maurice, 1980). Tracings are given in Figure 2. The number of NaI line components varies from two for HD 100841 (λ Cen) to at least 7. Practically all sodium-line components fall at negative radial velocities (LSR), in good agreement with rotation models (Ardeberg and Maurice, 1981). For most stars the sodium feature is dominated by two strong components with a difference close to 20 kms^{-1}. The minor line components vary considerably in strength as well as in position.

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Dame (left) and Bronfman discussing their poster. Background: Leisawitz explains his poster to Iwanowska. At right: Higgs. CFD

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