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A SOUTHERN ATLAS OF GALACTIC HYDROGEN
(The Region 240° ⩽ 1 ⩽ 359°, +3° ⩽ b ⩽ +17°)

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RESUMEN

Se presentan datos observacionales en la línea de hidrógeno neutro de 21-cm obtenidos con el radiotelescopio de 30-m del IAR. Las observaciones cubren la región 240° ⩽ *l* ⩽ 359°, +3° ⩽ b ⩽ +17° en intervalos de 1° tanto en 1 como en b. El intervalo de velocidad radial se extiende de −100 a +100 km s^{-1} con una resolución cinemática de 2 km s^{-1}.

ABSTRACT

We present observational data in the 21-cm line of neutral hydrogen, which were obtained with the 30-m dish of the IAR. The observations cover the region 240° ⩽ *l* ⩽ 359°, +3° ⩽ b ⩽ +17° at intervals of 1° in both 1 and b. The radial velocity interval extends from −100 to +100 km s^{-1} with a kinematical resolution of 2 km s^{-1}.

Key words: **21-cm OBSERVATIONS – GALACTIC STRUCTURE – GOULD BELT**

I. INTRODUCTION

We present here the results of observations covering the region 240° ⩽ *l* ⩽ 359°, +3° ⩽ b ⩽ +17°, with spacings of 1° in *l* and in b. This survey includes 1800 points in the southern sky. Together with the results by Pöppel and Vieira (1974) it constitutes part I of the southern atlas by Pöppel *et al.* (1979). Part III was already published by Olano, Pöppel, and Vieira (1981*c*), while Part II is in preparation (Franco and Pöppel 1985).

The aim of the observations was to study the properties of the low latitude HI-gas, excluding the complexity of the galactic plane (Vieira 1968, 1971). In particular, the results presented here were used for several studies related to the local gas associated with Gould's belt:

A comparative study of optical and radioastronomical data of a section of Gould's belt from 1 = 300°–372° (=12°) was made by Strauss, Pöppel, and Vieira (1979). The kinematics of interstellar HI in the regions 320° ⩽ *l* ⩽ 341°, +7° ⩽ b ⩽ +26° (in Scorpius-Lupus); 348° ⩽ *l* ⩽ 12°, +3° ⩽ b ⩽ +17° (in Scorpius-Ophiuchus); and 290° ⩽ *l* ⩽ 320°, +3° ⩽ b ⩽ +17° (in Crux-Centaurus) were considered by Olano and Pöppel (1981*b*), Franco and Pöppel (1978) and Olano (1985) respectively (cf. also Pöppel, Olano, Cappa de Nicolau 1982). Neutral hydrogen emission features in Scorpius and Ophiuchus were also considered by Olano and Pöppel (1981*a*), while some aspects of the interaction of the association Sco OB2 with the interstellar medium were studied by Cappa de Nicolau and Pöppel (1983, 1985). In addition, Olano (1982) made a new model of the local gas related to Gould's belt, fitting it to the observed radial velocities obtained from the 21-cm line observations.

In the region of the sky covered by our atlas, it is a good complement to the southern survey by Colomb, Pöppel, and Heiles (1977, 1980), since the latter excludes | b | < 10°, and has only a narrow velocity range (| v | ≲ 45 km s^{-1}).

II. OBSERVATIONS AND REDUCTION PROCEDURES

All the observations were made with the 30-m radiotelescope at Parque Pereyra Iraola, originally provided by the Carnegie Institution of Washington, constructed in Argentina by members of both institutions and operated by the personnel of the Instituto Argentino de Radioastronomía. The telescope had a HPBW of 30′ at the 21-cm line frequency. Further antenna characteristics were described by Bajaja, Colomb, and Morras (1980).

The 56 channel receiver was of the Dicke type with an input noise estimated to be of the order of 180 K.

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The total noise, adding spill-over radiation, losses in cables, and other noise sources, was estimated to be ∿250 K. The filters of the receiver had a half-width band pass of 10 kHz, equivalent to 2 km s^{-1}. We refer to Filloy (1974) for further details of the receiver.

The authors started the observations corresponding to part I of the atlas in July 1968, extending them to January 1970. Due to a long interval during which the equipment was not in operation, it was necessary to stop until September and October 1970. Further observations were made in March 1971, and from July 1971 to January 1972.

Each point in the sky was observed at least twice, at different dates. In those cases where the agreement between them was not good enough, additional observations were carried out (January 1973 to January 1974). Results were finally averaged. A small set of profiles (∿ 2 or 3%) was excluded from the averages because of excess of noise or base-line uncertainties.

All the observations were made at two different local oscillator settings, separated by ∿ 47.5 kHz (10 km s^{-1}). Therefore, a hydrogen profile for a given point in the sky consists of 112 values for the antenna temperature, spaced at 2 km s^{-1}. The total integration time used for each profile was 6 minutes.

In general, the base lines of the profiles were approximated empirically by drawing straight lines through the extremes, so far as these seemed to be free of hydrogen. The intrinsic average uncertainty for the profile is ∿ 0.7 K due to noise. To this we must add ∿ 0.8 K due to base line indeterminacy and ∿ 3% of the brightness-temperature T due to channel gain uncertainties. These numbers were somewhat improved after the installation of a new parametric amplifier in the front-end in February 1973, when most of the observations were already finished. The range in radial velocity v covers the interval −100 to + 100 km s^{-1}; v is referred to the local standard of rest and has an accuracy better than 1.0 km s^{-1}. The reductions were performed in the same way as described by Olano *et al.* (1981*c*). In order to calibrate the scale of T, a set of reference points was used (Pöppel and Vieira 1973). The brigthness temperature scale adopted by us should agree within the observational uncertainty with the common scale which has been proposed by Harten, Westerhout, and Kerr (1975). We refer to Olano *et al.* (1981*c*) for further details.

The number of profiles observed in part I of our atlas was about 4266, representing a net observation time of about 427 hours. The total number of hours required, including the antenna pointings, the oscillator settings, the channel dischargings, and most of all, the observational work related to the temperature-scale calibration, is larger by a factor of at least 2.

III. OBSERVATIONAL RESULTS

The observations are presented in the following sets of diagrams on microfiche:

a) Contour maps in the b–v plane, at constant values of longitude (l = 359°, 358°,. . ., 240°) and for T = 5K, 10K,. . . (Figures 1-120).

b) Contour maps in the l-v plane, at constant values of the latitude (b = +3°, +4°,. . ., +17°) and for T = 5K, 10K,... . The maps are grouped together according to the following l-regions:

330° ⩽ l ⩽ 359°	(Figures 121-135),
300° ⩽ l ⩽ 330°	(Figures 136-150),
270° ⩽ l ⩽ 300°	(Figures 151-165),
240° ⩽ l ⩽ 270°	(Figures 166-180).

c) 1800 averaged profiles arranged in groups of 5 each. These are given in order of increasing l and b: l = 240°, b = +3° to +7° (Figure 181); l = 240°, b = +8° to +12° (Figure 182); l = 240°, b = +13° to +17° (Figure 183); l = 241°, b = +3° to +7° (Figure 184); . . .; l = 359°, b = +13° to +17° (Figure 540).

The coordinates used throughout these diagrams are galactic longitude l and latitude b, radial velocity v reduced to the LSR, and brightness temperature T.

The whole Atlas is also available on magnetic tape.

IV. COMMENTS ON THE RESULTS

As stated above, the total average uncertainty in the temperatures T is ∿ 1.5 K plus 3% of T; therefore, the observations are not adequate for detecting weak signals of less than, say, 3K. On the other hand, the velocity range is restricted to ±100 km s^{-1}. For both these reasons, our survey is not adequate for detecting typical high-velocity clouds. Such sort of objects have been surveyed at the IAR, once a new, more sensitive 21-cm line receiver was installed in 1979 (Bajaja *et al.* 1985).

In order to make some comments on the probable origin of the radiation which we have detected throughout our observations, we shall consider the gas of positive radial velocities and that of negative ones separately.

A glance at Figures 1-120 shows an intense ridge-like feature of low velocities which includes most of the positive-velocity gas present for l > 300°. This gas seems to be related to Gould's belt (cf. the references given above), i.e., it should be local gas. One exception is Cugnon's (1968) feature at v ∿ +50 km s^{-1} (Figures 10 to 15 and 121b, 122), which could be gas ejected from the galactic center (cf. Mirabel, Pöppel, and Vieira 1975).

In addition, for l ⩽ 289° there are several low-latitude features of positive velocities (Figures 71 to 120). These are lower than about +50 km s^{-1} for l > 268° (Figures 71 to 92 and 151, 152). For lower l (i.e., in the third galactic quadrant), the HI-profiles have broad wings extending up to velocities, which could be larger than +80 km s^{-1} (Figures 104 to 120 and 166 to 168). Kinematic models of the Galaxy would locate all these positive-velocity features outside the galactic solar circle, at distances not larger than a few kpc from the Sun.

Now, let us consider the negative-velocity gas. In the region l < 300°, the mean velocity of the ridge-like object generally is slightly negative. This happens also for values of l belonging to the third galactic quadrant ($l < 270°$), where negative velocities are absolutely forbidden for circular motions (Figures 166 to 180). Again the gas should be local.

Besides, there are several negative-velocity features in the region $l = 320° - 290°$ (Figures 40 to 70), which were analyzed by Olano (1985). Following his results, one of the features, having $v \sim -10$ km s^{-1}, should also be local gas; another feature, having $v \sim -20$ km s^{-1}, probably is related to the Sgr-Car arm, located at about 1.5 kpc from the Sun. Finally, a third feature has $v \sim -30$ km s^{-1} and should be somewhat more distant.

In addition, there are many features of low negative velocities in the region $l > 320°$ (cf. for example Figures 121 to 128). Let us mention a local feature having $v \sim -12$ km s^{-1} and $b > 10°$ (Figures 130 to 135). It was first described by Sancisi and van Woerden (1970). Their observations were extended to the south by Olano and Pöppel (1981*a*). Other features appear for $l = 353°$ to $349°$ in the velocity range $v = -10$ to -5 km s^{-1} (Figures 7 to 11) and for $l = 344°$ to $341°$ at $v \sim -27$ km s^{-1} (Figures 16-19). Again, if we consider the standard technique of relating gas velocity to distance on the assumption of purely circular motions as a first approximation, such features could be located within the galactic solar circle generally at moderate distances from the Sun a few kpc considering their angular extension and b-values).

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