24. A STUDY OF SPIRAL STRUCTURE FOR $270° \leqslant l^{II} \leqslant 310°$

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A survey of the distribution of the intensity of the 21 cm-line of atomic hydrogen in the region with galactic coordinates $270° \leqslant l^{II} \leqslant 310°$, $-3° \leqslant b^{II} \leqslant 2°$, was made with the 100-foot radiotelescope and 56-channel receiver of the Radio Astronomy Station of the Instituto Argentino de Radioastronomía and the Department of Terrestrial Magnetism of the Carnegie Institution of Washington. The angular and velocity resolution of the system is 28′ of arc and 2 km s^{-1}.

The analysis of the data included the identification of hydrogen concentrations, and the study of their interconnection, which gives rise to the different structures that produce the spiral appearance of the Galaxy.

We found concentrations with velocities forbidden by Schmidt's mass model of the Galaxy. We also find that the sun seems to have a priviliged position when linear density variation is studied. This can be due to errors in distance determination, to a temperature effect (that was considered uniform throughout all concentrations) or to a velocity dispersion effect arising from the assumption of Gaussian components.

The above indicates that our results must be taken as a merely approximate picture of the actual situation.

We estimate the errors which may result from the mass model. For some longitudes, errors affecting the determination of distances can reach values up to 3.6 kpc for very small velocities (less than 10 km s^{-1}) while for greater velocities they can be of the order of 0.4 kpc.

From the general analysis of our observations it is obvious that the structures present a big amount of fine structure. Structures are made up by a sequence of concentrations with similar features (velocity, size, velocity dispersion, position relative to the galactic plane); sometimes very small clouds are resolved within these concentrations. This can be clearly seen in the case of local hydrogen.

We study the distribution of local hydrogen, and it is found that the sun is probably located in the inner edge of the local structure.

Small concentrations with narrow profiles and high temperature are easily found at zero velocity, especially at latitudes above and below the plane where the local structure and the local hydrogen can be separated.

In order to obtain an approximate picture of the Galaxy, a velocity-longitude diagram for the concentrations was drawn (Figure 1). This diagram should show continuities between concentrations, that is, spiral structures. However, we cannot predict, just from this diagram, the possible connections between concentrations, since they are at different distances from the galactic plane. Therefore their distribution in z must also be considered.

Taking this into account and using criteria about the velocity dispersion and size

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of the concentrations we have drawn the general diagram presented in Figure 2.

The most important feature that appears from this graph is that, even when the structures approximately follow the general lines of spiral arms, they are broken into concentrations whose values of N_H, positions relative to the plane, size and dispersion in velocity are variable.

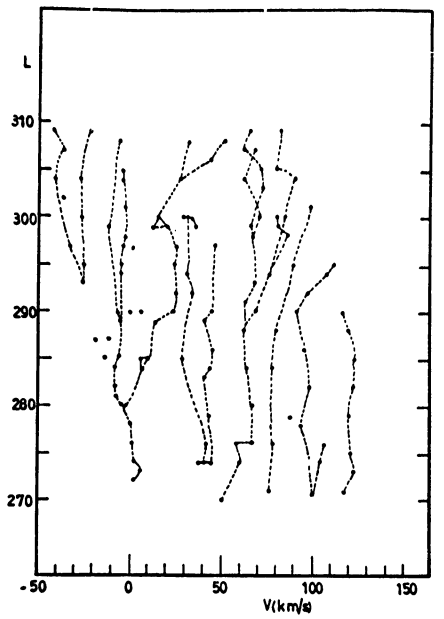

Fig. 1. Velocity-longitude diagram for the hydrogen concentrations. The longitude and the velocity are those corresponding to the maximum temperature.

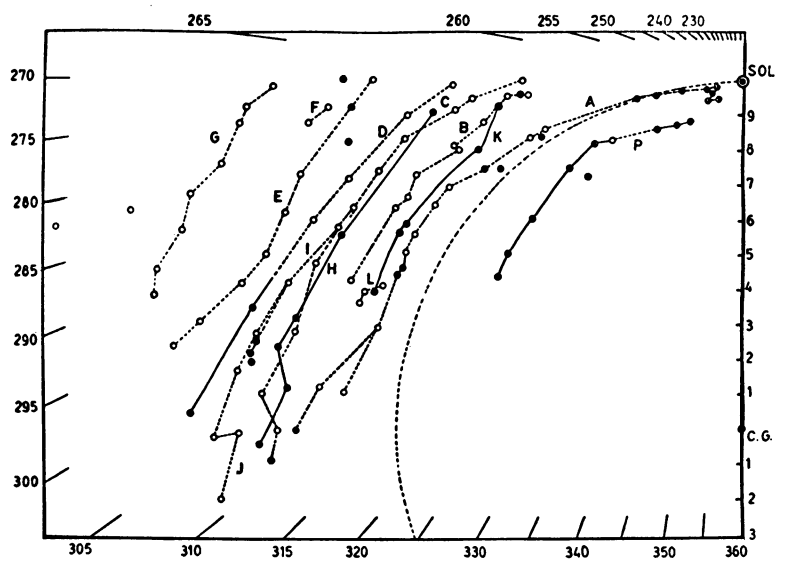

Fig. 2. General diagram of Galactic structure.

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A study of the distribution of hydrogen in the Carina and Sagittarius arms was made in order to determine their location and the possibility of fitting them to arms in the Eastern galactic hemisphere. Figures 1 and 2 let us conclude that the Carina structure does not go through the sun but tends towards Sagittarius.

The position of these structures does not agree with the position of the structures given by optical objects, but the region of low density of stars and gas near the Carina edge is real and not an effect caused by local obscuration; however, the stellar and gaseous 'holes' are shifted in longitude.

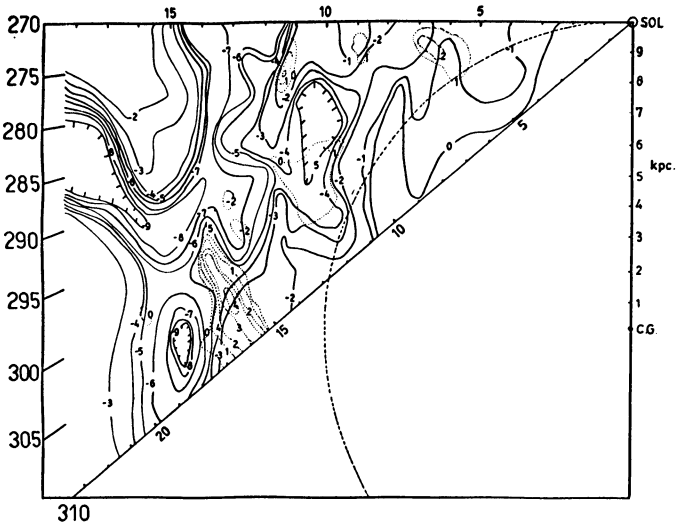

Fig. 3. The lines show the position relative to the plane of all the structures. Full lines denote negative z values, dotted lines positive ones.

Concentrations with many different features were found. It is remarkable that many of them have high velocities and also that some of them are located at great negative distances from the plane.

The bending of the plane is obvious in the region studied, and it looks that the general tendency is in the direction of the Large Magellanic Cloud.

We also find concentrations with very low temperature and velocity dispersion, subtending small angles and located principally on and above the galactic plane in those regions where the main structures bend beneath it. We assume that they are the product of some secondary effect of the forces that caused the bending of the plane.

Acknowledgement

This paper is a brief summary of my Ph.D. Thesis that will be published in full (in Spanish in the *Anales de la Sociedad Científica Argentina*). A more extended English version will be published elsewhere.