Rev. Mexicana Astron. Astrof., **6**, 55-58 (1981)

NEUTRAL HYDROGEN IN THE SMALL MAGELLANIC CLOUD

N. Loiseau[1] and E. Bajaja[2]

Instituto Argentino de Radioastronomía

RESUMEN

Se realizó un relevamiento en la línea de 21 cm de la Nube Menor de Magallanes. Se presenta un análisis preliminar de las observaciones.

ABSTRACT

We made a 21 cm survey with high velocity resolution of the Small Magellanic Cloud. We present a preliminary analysis of these observations.

Key words: **GALAXIES-INDIVIDUAL – RADIO SOURCES-LINES**

The Small Magellanic Cloud is an irregular galaxy which seems to be extended along the line of sight. This conclusion has been reached for example, from studies of supergiants (Ardeberg and Maurice 1979) and from the high rate of star formation per unit surface area (Israel 1980).

The observed irregularities in distribution and kinematic of neutral hydrogen, H II regions (Smith and Weedman 1973), supergiants (Ardeberg and Maurice 1979) and other objects have been attributed, according to current models, to the presence of a bar in the direction of the line of sight (de Vaucouleurs and Freeman 1972), or the existence of a warp in the direction of the Large Magellanic Cloud (Maurice 1979).

In order to study these structures in more detail, we made an H I survey with a rather high velocity resolution (2 km s^{-1}), with the IAR 30 m dish (HPBW = 30$'$). A set of 56 filters, 10 kHz wide, spaced 18.9 kHz, was used. The SMC has been already observed by Hindman and Balnaves (1967) with the Parkes 64-m dish, but with a velocity resolution of 7 km s^{-1}.

We observed the region defined by $0^h < \alpha < 2^h$, $-76^\circ < \delta < -70^\circ$, scanning it twice at constant declination every $0^\circ\!.25$, at two local oscillator frequencies spaced 47.4 kHz (10 km s^{-1}). The integration time was 90 seconds.

In this way we obtained about 5000 profiles. These profiles were reduced and convolved to produce corrected profiles on a rectangular grid on the sky. The rms noise in the resulting profiles is approximately 1°K.

The profiles were used to produce about 40 contour maps for H I density and velocity distributions. Some of these maps are shown in Figures 1 and 2.

1. Becaria del CONICET, Argentina.
2. Miembro de la Carrera del Investigador Científico del CONICET, Argentina.

In the H I profiles it is possible to identify four main components spread over the galaxy. In spite of the local peculiar movements indicated by these components it is possible to get an approximate picture of the global movement of the galaxy computing the median velocities of the profiles. In Figure 3 the median velocity contour map shows clearly a rotation whose regularity is perturbed in the region of the wing and Kl features, due to the influence of different velocity components.

The approximate position angle of the major axis and coordinates of the center of rotation of the galaxy, as derived from Figure 3, are P.A. = 57° and $\alpha_c = 15^\circ\!.25$, $\delta_c = -72^\circ\!.5$, respectively.

In Figure 4 the rotation curve has been represented as obtained from the median velocities along this major axis. The systemic velocity as derived from this curve is 19 km s^{-1}, with respect to the center of the Galaxy (assuming for the sun a rotation velocity of 225 km s^{-1}). The maximum rotation velocity projected along the line of sight is 36 km s^{-1}.

Assuming for the SMC a distance of 66 kpc (Gascoigne 1972), the total hydrogen mass has been estimated as $(6.6 \pm 0.5) \times 10^8\ M_\odot$.

REFERENCES

Ardeberg, A. and Maurice, E. 1979, *Astr. and Ap.*, 77, 277.
de Vaucouleurs, G. and Freeman, K.C. 1972, *Vistas in Astronomy*, 14, 163.
Gascoigne, S.C.B. 1972, *Quart. J.R.A.S.*, 13, 274.
Hindman, J.V. and Balnaves, K.M. 1967, *Australian J. Phys. (Astrophys. Suppl.)*, No. 4.
Israel, F.P. 1980, *Astr. and Ap.*, 90, 246.
Maurice, E. 1979, Thèse de Doctorat d'Etat.
Smith, M.G., Weedman, D.W. 1973, *Ap. J.*, 179, 461.

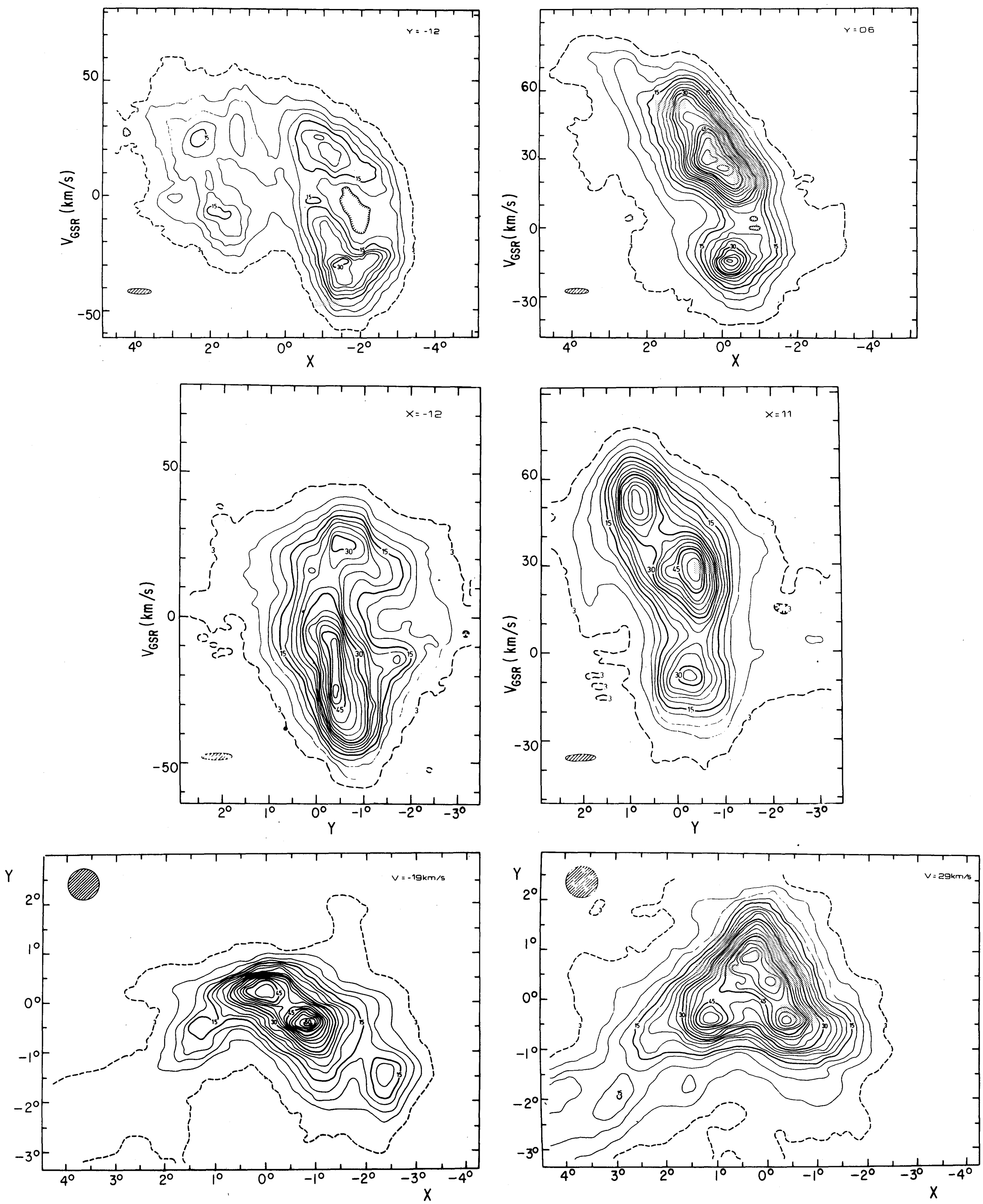

Fig. 1. H I contour maps for the SMC. Rectangular coordinates X, Y are centered at $\alpha = 15°$, $\delta = -73°$. Velocities are with respect tc galactic center correcting the LSR velocities by $V_{GSR} = V_{LSR} + 225 \sin \ell \cos b$. Contour levels are in °K of brightness temperature.
a), b): Velocity–X contour maps at indicated Y.
c), d): Velocity–Y contour maps at indicated X.
e), f): X–Y contour maps at indicated V.

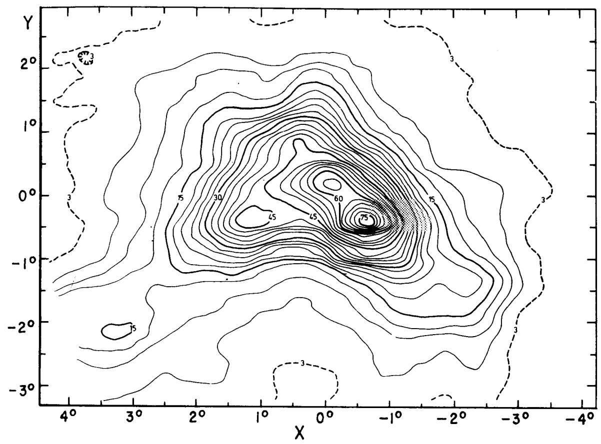

Fig. 2. H I density distribution contour map. Contour levels in units of 10^{20} atoms cm^{-2}.

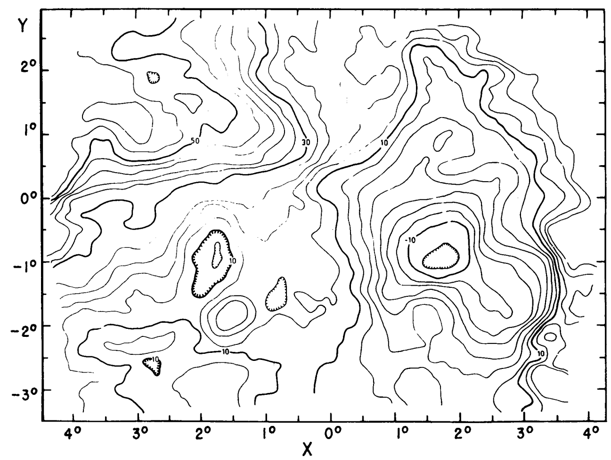

Fig. 3. Median velocity contour map. Contour levels in km s^{-1}.

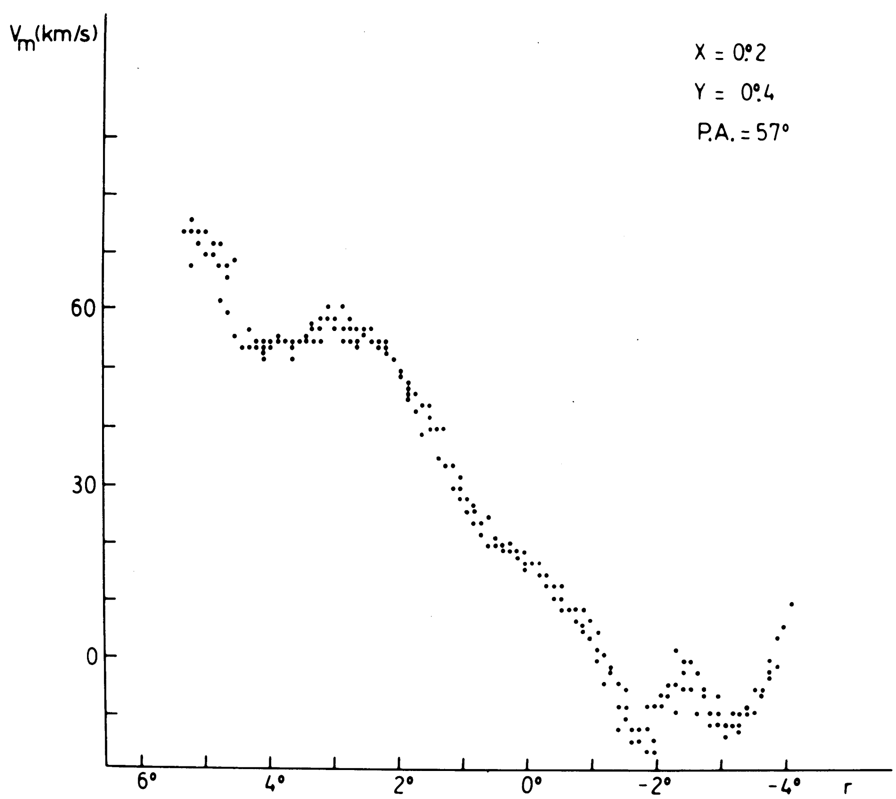

Fig. 4. Rotation curve along the major axis derived from Figure 3.

DISCUSSION

Pişmiş: A partir de la curva de velocidad de la nube se puede determinar la masa total del objeto. ¿La han determinado?

Loiseau: No, no lo hemos determinado. En la figura de la velocidad mediana constante se puede ver que, si bien en la dirección del eje mayor de rotación parece bastante regular, en la dirección del ala hay fuertes perturbaciones. Si determináramos la masa total a partir de la curva de rotación no estaríamos tomando en cuenta la masa involucrada en esa perturbación.

Mirabel: ¿Existe alguna evidencia en la morfología de la Nube Menor sobre fuertes perturbaciones gravitacionales debidas a la Vía Láctea o Nube Mayor?

Loiseau: La distribución del H I y el análisis de las componentes en velocidad indican claramente que la Nube Menor es una galaxia perturbada. Maurice propuso que la prominencia en la dirección del ala podría ser el puente que según el modelo de Toomre se produjo al pasar la Nube a unos 20 kpc del centro galáctico. La dirección y las distancias de estrellas supergigantes asociadas están de acuerdo con el modelo. Pero no se puede explicar con este modelo la presencia de las dos componentes que se observan en H I en esa zona.

Esteban Bajaja and Nora Loiseau: Instituto Argentino de Radioastronomía, Casilla de correo No. 5, 1894 Villa Elisa, Buenos Aires, Argentina.