The French H II Region Programme in the Large Magellanic Cloud

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In parallel with the photometric and spectrometric observations of LMC stars undertaken at the Marseille Observatory, and for which E. Maurice recently presented a summary (*The Messenger*, No. **7**, December 1976), interferometric observations of H II regions have been made from 1969 to 1973 at La Silla.

Dr. Marie France Duval (before: Chériguène) has studied the gaseous content of the Large Magellanic Cloud in collaboration with other French astronomers, mainly from the Marseille Observatory. She summarizes the main results of the La Silla observations.

Evidence of an Extended H II Region in the Centre of the LMC

During their first mission, in 1969, Y. Georgelin and G. Monnet used a 4-inch refractor equipped with a Perot-Fabry interferometer, giving a mean dispersion of 25 Å mm^{-1}

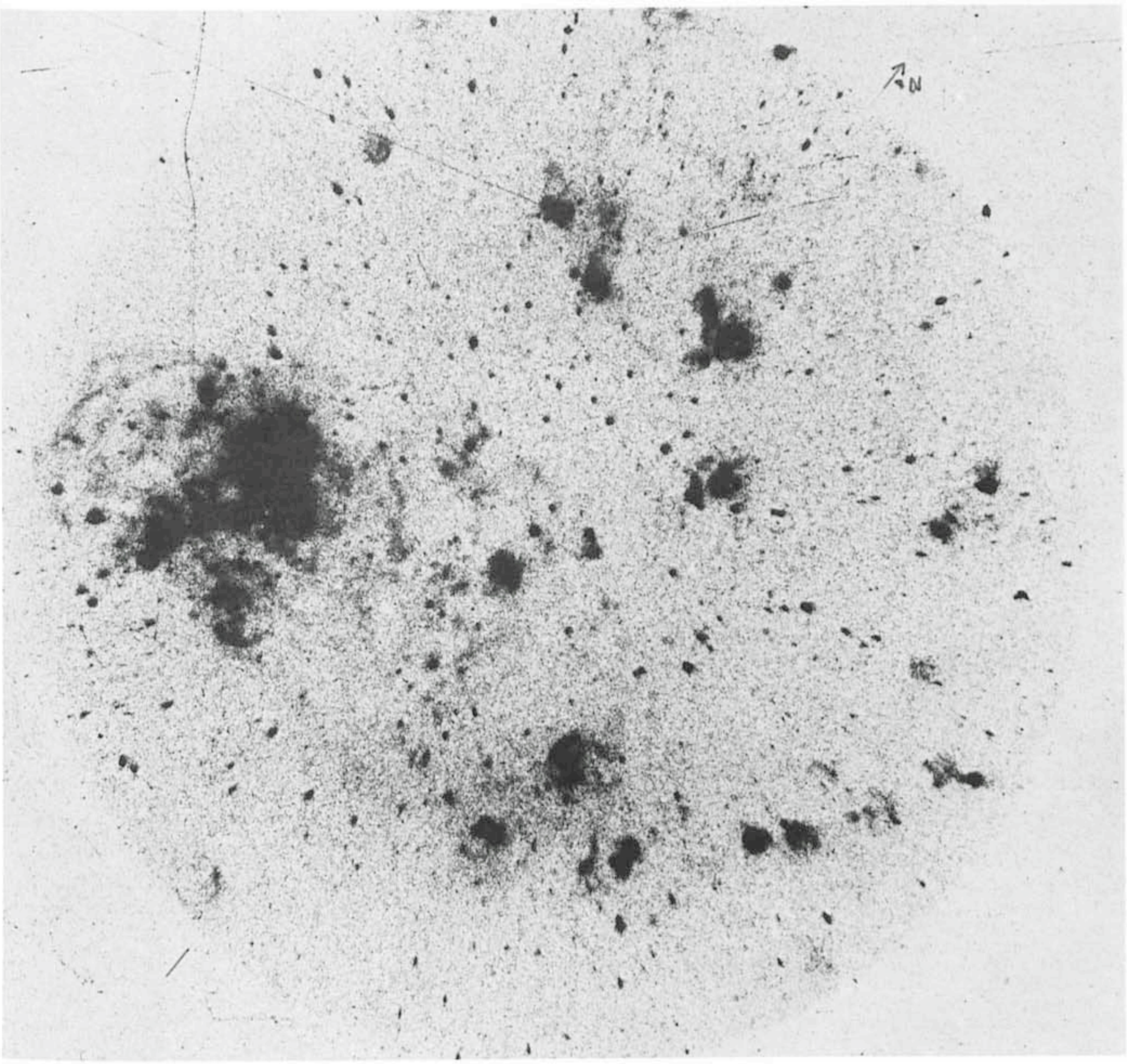

Fig. 1. — *Monochromatic photograph of the LMC in Hα (interference filter 8 Å wide). Field of view: 4°.5. Note the elliptical, extended H II region of size 1° x 2°.*

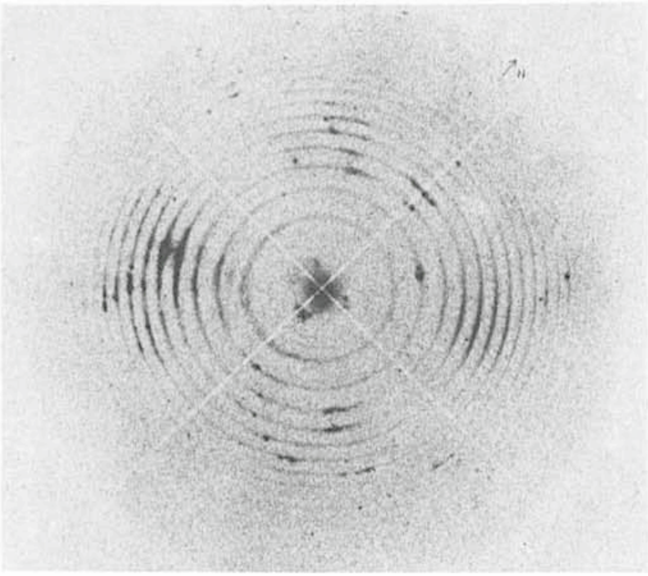

Fig. 2.— *Perot-Fabry interference rings projected on the same fields as in figure 1.*

at Hα, and obtained 11 plates covering circular fields of 4°5 in diameter.

A monochromatic photograph in Hα was also taken, which corroborates the presence of a very large ionized region of 1° x 2°, centred at 5^h30^m, −69°30′ (Fig. 1), as previously discovered from the radio continuum emission at 1410 MHz (Mathewson and Healey, 1964). The low velocity dispersion ($\simeq$ 7 km s^{-1}) and the differential rotation measured for this region lead us to suppose that the emission comes from an ionized hydrogen disk not thicker than 200 pc.

Kinematic Results

The first plates resulted in considerable progress in the radial-velocity determination of H II regions and of the ionized hydrogen disk: 250 radial velocities were published by Y. Georgelin and G. Monnet in 1970 (*Astrophys. Letters* **5,** 213). The radial-velocity programme was continued in 1970 and 1973 during two observing runs at the 150-cm telescope by M. F. Duval and G. Monnet who obtained 70 interferograms covering circular fields of 20 arc min, from which a total of not less than 1,500 points were measured; they represented 101 regions listed by Henize (1956) and 41 other regions of 12′ x 12′ (larger than Henize's size limit). The results were published in 1972 and 1974 (*Astron. & Astrophys.* **16,** 28; "CNRS colloque sur la dynamique des galaxies spirales", 439).

Rotation and Mass of the LMC

The centre of the LMC bar (5^h24^m, −69°8) being the only well-defined geometrical point, we tried to specify its systemic velocity. Considering previously published results on the radial velocities of the H II regions as well as our own determinations, we adopted the following value: 34 ± 3 km s^{-1} (assuming a local galactic rotation velocity of 250 km s^{-1} and a solar motion with respect to the L.S.R. of 16 km s^{-1} in the direction of l = 53°, b = 25°). This value is slightly different from that of 44 km s^{-1} determined by means of stars at the Marseille Observatory (Prévot, 1972). The position angle of the major axis was calculated to be the same as for stars, i. e. 180°.

Assuming, as a first approximation, a circular rotation around the centre of the bar, we calculated the rotation velocity as a function of the distance from the centre. Figure 3 shows clearly the differential effect, and confirms the northward displacement of the symmetry centre of the rotation curve.

The mass estimated from this curve is 0.7×10^{10} $M_\odot$; whereas the theoretical model proposed by G. de Vaucouleurs and K. C. Freeman—which uses the distance between the centre of the bar and the centre of the disk (40′ ± 6′), the positions of the neutral points of such a system and the angular velocity of the disk (45 km s^{-1} kpc^{-1})—gives the following masses with our values:

$$M_{disk} = 1.2 \pm 0.6 \times 10^{10}\ M_\odot$$
$$M_{bar} = 1.9 \pm 1.5 \times 10^{9}\ M_\odot$$

The Large Magellanic Cloud is a very interesting system for the dynamical study of barred galaxies because of the wealth of kinematic results obtainable with H II regions (dispersion less than 10 km s^{-1}) and stars. This work integrates very well into a more general study of barred galaxies of types SBb to IBm that the author is now carrying out in the northern hemisphere.

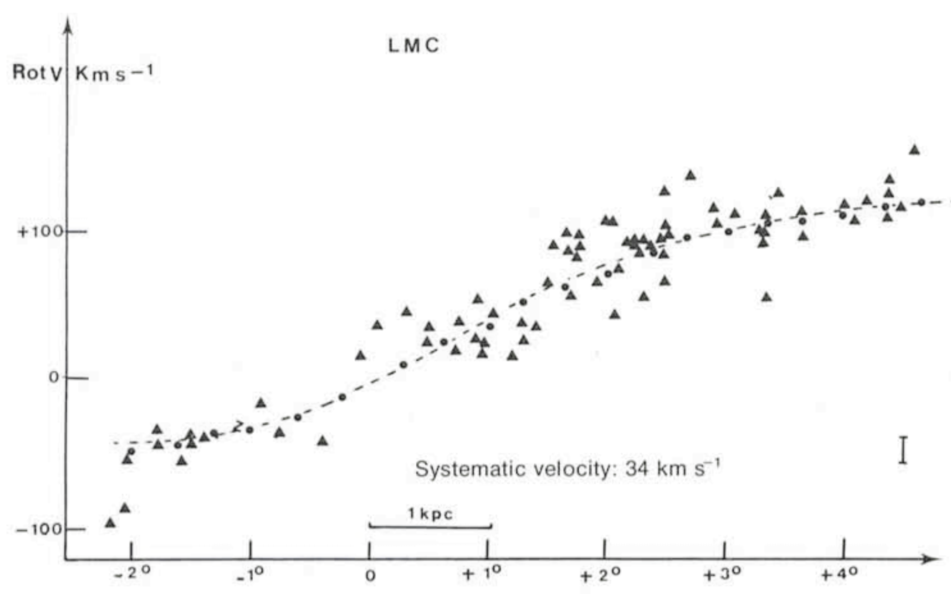

Fig. 3. — *Rotational curve of the LMC (the tilt angle i = 63°, the major axis' position: 180°).*