THE RADIO CONTINUUM OF THE LARGE MAGELLANIC CLOUD

II.* CONTINUUM OBSERVATIONS AT 11 CM WAVELENGTH

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Abstract

Contour diagrams are presented for the radio continuum brightness of the Large and Small Magellanic Clouds observed at a wavelength of 11 cm. The observations were made with the Parkes 64 m radio telescope, whose half-power beamwidth was 7′·35 arc.

I. Introduction

A preliminary report of the present survey of the Magellanic Clouds at 11 cm wavelength has been given by Broten (1965). Detailed maps of the brightness observed in both galaxies, the Large and Small Magellanic Clouds (LMC and SMC), are now presented.

II. Equipment and Methods of Observation

The observations were carried out in 1964 at Parkes using the 64 m radio telescope equipped with an 11 cm low noise receiver designed and built by Cooper, Cousins, and Gruner (1964). The effective system noise temperature was 180 K. The antenna beam was measured as 7′·35 arc between half-power points. Slight evidence was present in the beam diagram to suggest coma broadening at the lower levels (<-13 dB), but this does not significantly affect the results. The antenna side-lobe level was more than 20 dB down.

Two complete and independent surveys were undertaken. In the first survey, scans were made in declination spaced at 45 s ($\sim 3'\cdot8$ arc) in right ascension. Two scans were taken at each right ascension setting. These were compared and at least one had to be rated "good" before proceeding to the next setting. Scans subject to excessive noise, interference, or baseline drifts arising from changes in ambient temperature or other causes were discarded.

In the second survey, the declination scans were spaced at 30 s ($\sim 2'\cdot5$ arc) in right ascension and at least two "good" scans were accepted for each setting. Tie scans in right ascension were made at four declinations in the LMC and at three declinations in the SMC. Later observations were made through the peaks of the emission regions.

The scale of full-beam brightness temperature was calibrated with signals from a noise lamp whose deflection in turn was compared directly with the radio source Hydra A at least twice per night during the survey. Thus the temperature scale is referred directly to the 11 cm flux density of Hydra A ($23\cdot5\times10^{-26}$ W m^{-2} Hz^{-1}). Intermediate intensity calibrations were available by regularly observing the

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comparatively strong sources Henize 132D in the LMC and Henize 66 in the SMC and also a few other conveniently situated sources whose flux densities had been measured relative to Hydra A.

III. The Contour Diagrams

Contour maps were constructed from the combined data of both surveys. In order to provide information additional to that obtained in the declination scans, the two sets were smoothed and intensities were read off at spacings of $2'{\cdot}5$ arc in right ascension. This enabled the existing information in the right ascension scans to be greatly reinforced.

Figure 1 shows the general disposition of sources in the LMC. The limits of the survey, which covered some 36 sq deg of the LMC, are indicated by the heavy boundary lines. Figures 2–9 contain the detailed contour diagrams of the LMC sources. Figures 2 and 3 extend east from R.A. $\sim 04^h\,50^m$ with the more northerly declinations first. Figures 4, 5, and 6 extend east from R.A. $\sim 05^h\,10^m$ covering Dec. $-65°\,40'$ to $-70°\,30'$. Figures 7, 8, and 9 extend east from R.A. $05^h\,29^m$ and cover Dec. $-67°\,00'$ to $-71°\,30'$.

The SMC is covered by Figures 10, 11, and 12. A general picture of the important sources is shown in Figure 10. Figure 11 repeats in greater detail the emission seen in the vicinity of the bar of the SMC. Figure 12 shows the only other radiation detected from this galaxy at some distance to the south-west from the bar.

The labels on the contours are in units of $0{\cdot}1$ K of full-beam brightness temperature. The lowest level contour ($0{\cdot}05$ K) is shown as a dashed line in all the figures. The contour interval is 1 unit ($0{\cdot}1$ K) between $0{\cdot}1$ K and $0{\cdot}6$ K but increases above $0{\cdot}6$ K as indicated on the contours.

The coordinates of right ascension and declination are for epoch $1975{\cdot}0$. The mean precession to $1950{\cdot}0$ at a representative point in the LMC (R.A. $05^h\,30^m$, Dec. $-69°\,30'$) is $+11{\cdot}8$ s in right ascension and $-1'{\cdot}1$ arc in declination, while for a representative point in the SMC (R.A. $00^h\,50^m$, Dec. $-73°\,00'$) it is $-53{\cdot}3$ s in right ascension and $-8'{\cdot}2$ arc in declination. For any one map the displacement and rotation of the coordinates between the two epochs may be determined by calculating the precession for a few points on the map.

IV. Acknowledgments

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V. References

Broten, N. W. (1965).—Proc. Symp. on Magellanic Clouds, Mt. Stromlo Obs., Canberra, pp. 72–5.

Cooper, B. F. C., Cousins, T. E., and Gruner, L. (1964).—*Proc. Instn Radio electron. Engrs Aust.* **25**, 221–7.

Figs. 1–12.—Contours of continuum emission from the Magellanic Clouds at 11 cm wavelength. The contours are marked in units of $0{\cdot}1$ K full-beam brightness temperature. The antenna beamwidth was $7'{\cdot}35$ arc at half-power points.

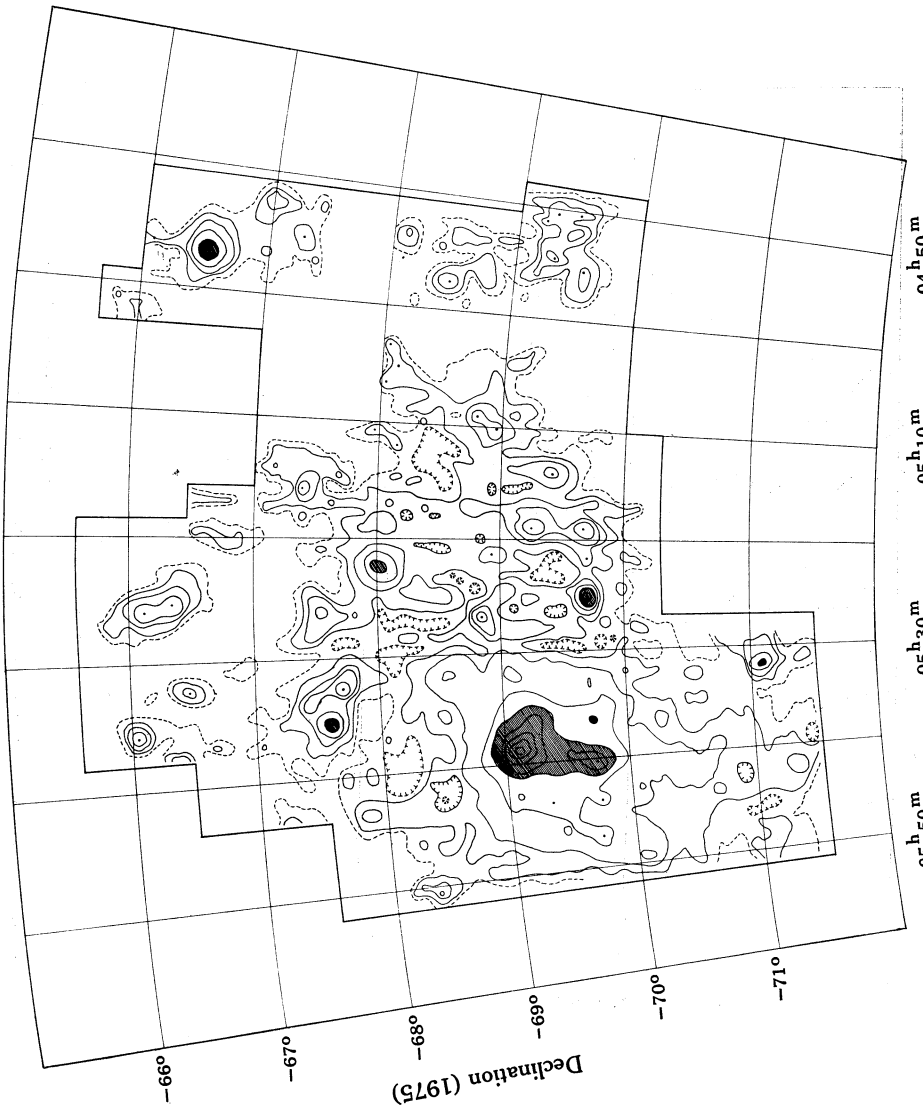

Fig. 1.—General disposition of sources in the LMC.

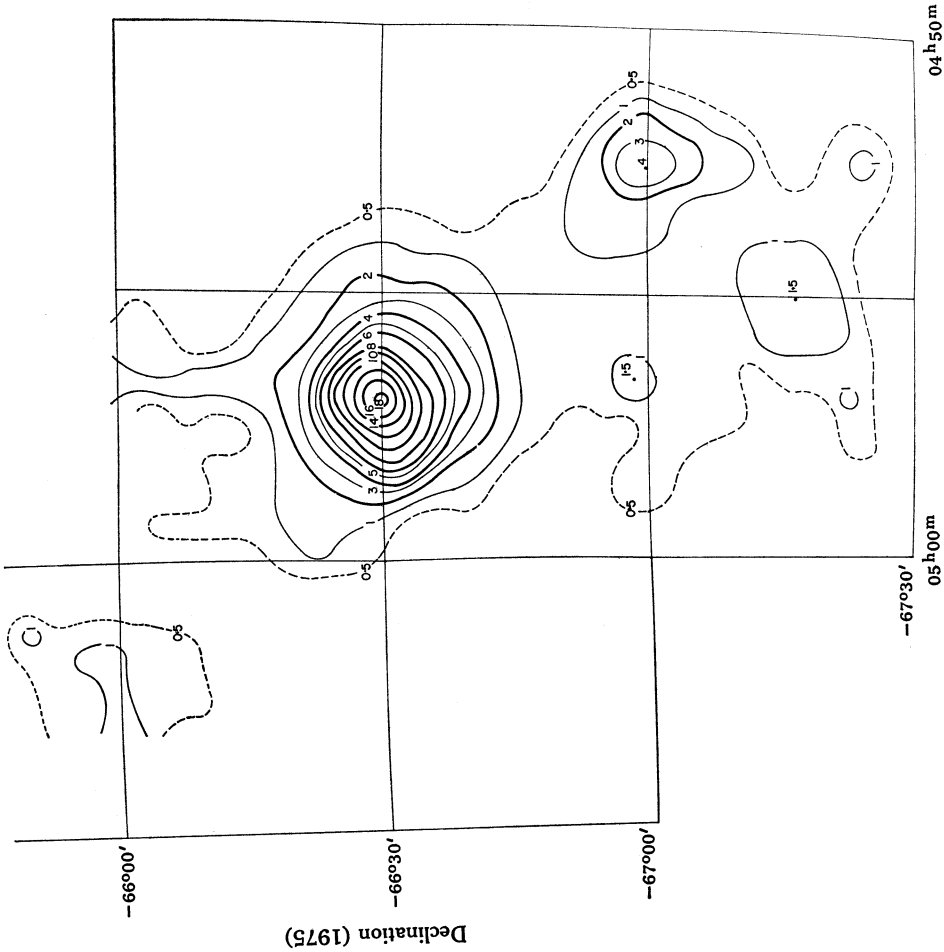

Fig. 2.—Detailed contours for the LMC, R.A. $04^h\,50^m$ to $05^h\,05^m$, Dec. $\sim -66°\,00'$ to $-67°\,30'$.

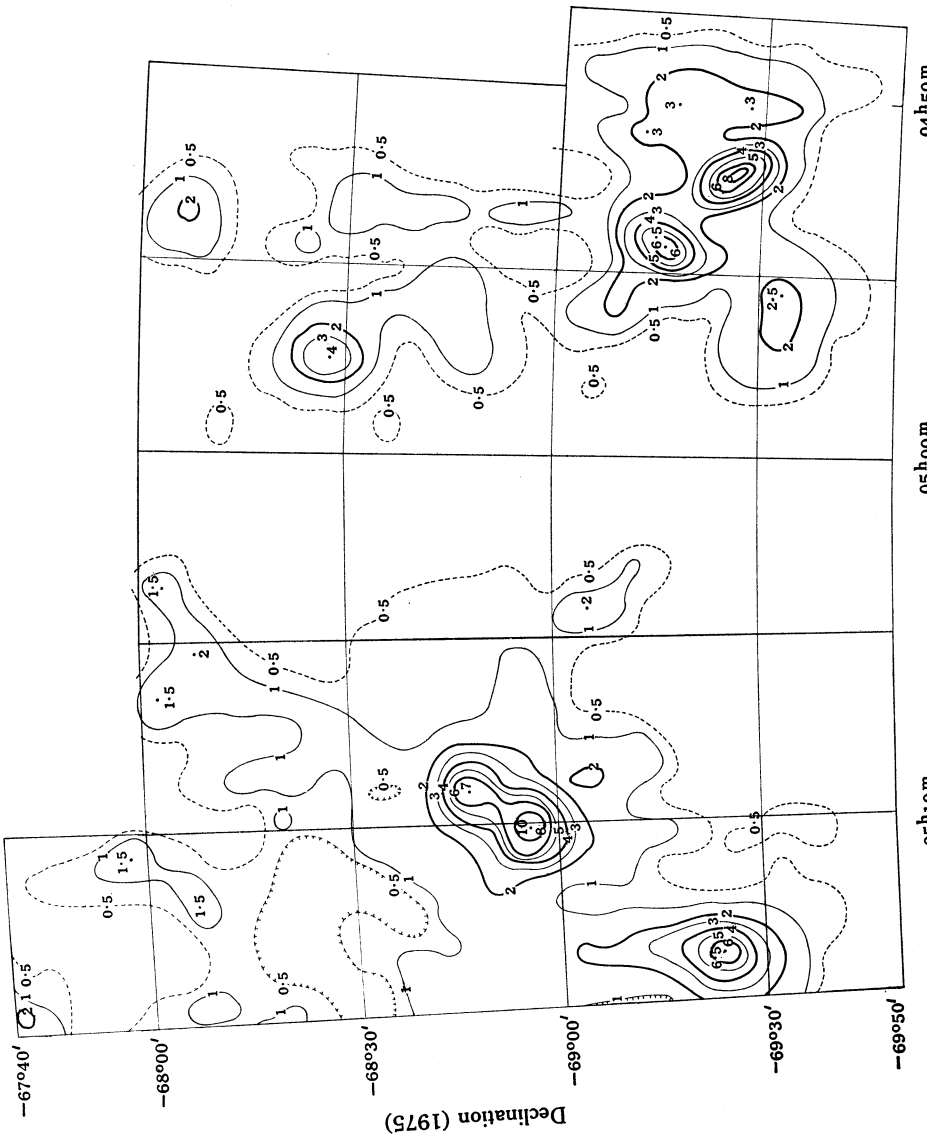

Fig. 3.—Detailed contours for the LMC, R.A. ~ $04^{h}\,50^{m}$ to $05^{h}\,15^{m}$, Dec. ~ $-68°\,00'$ to $-69°\,50'$.

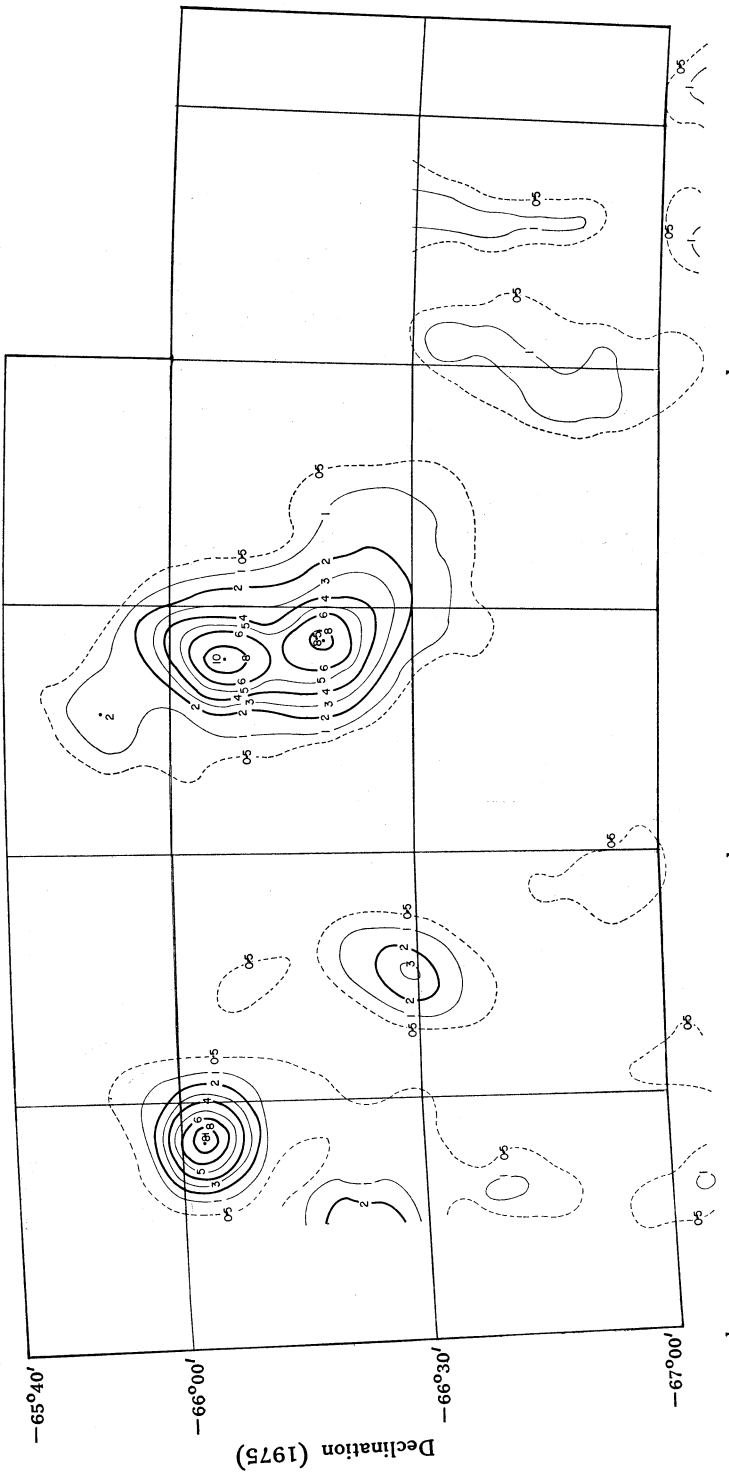

Fig. 4.—Detailed contours for the LMC, R.A. ~ $05^h\,15^m$ to ~ $05^h\,40^m$, Dec. $-65°\,40'$ to $-67°\,00'$.

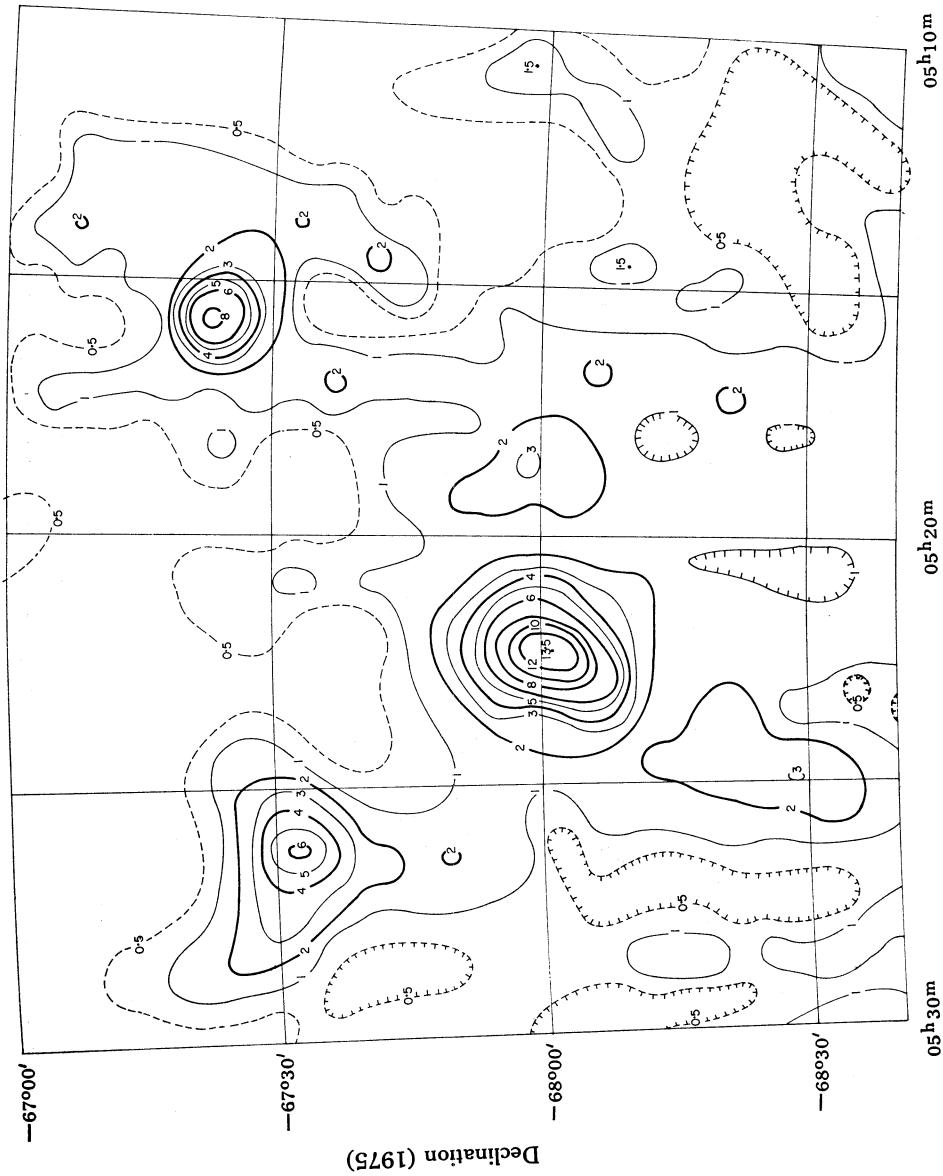

Fig. 5.—Detailed contours for the LMC, R.A. 05h 10m to 05h 30m, Dec. —67° 00′ to —68° 40′.

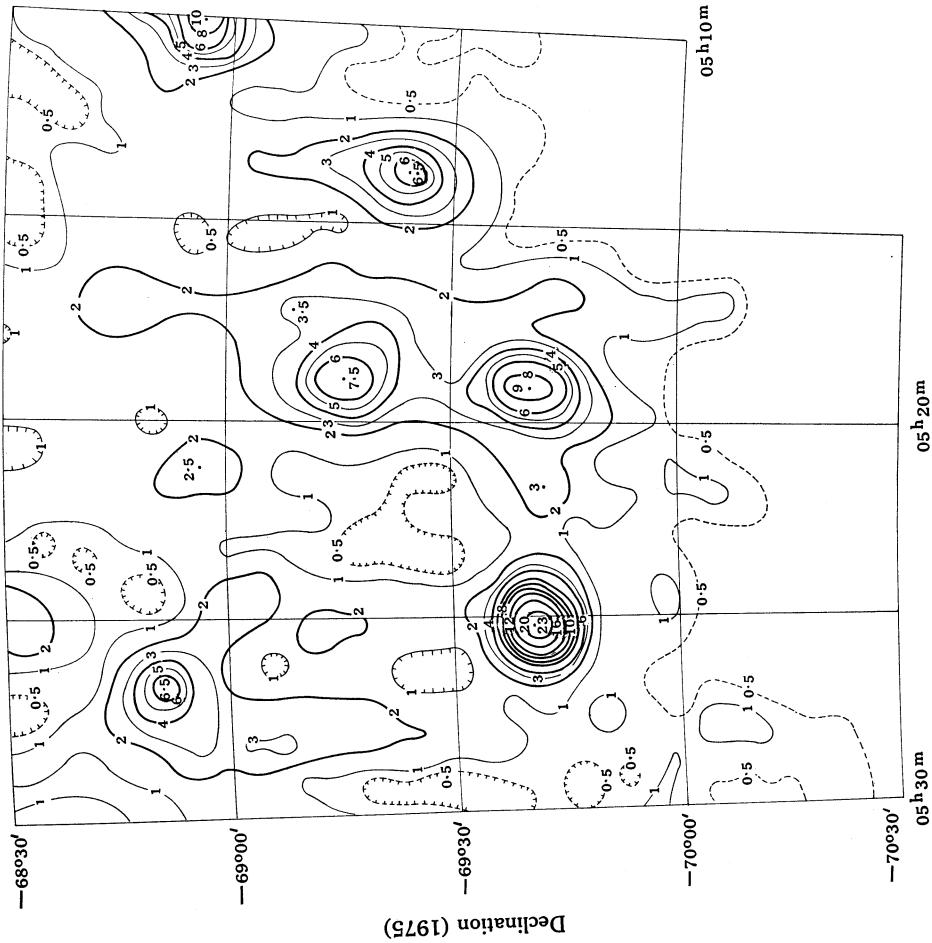

Fig. 6.—Detailed contours for the LMC, R.A. 05h 10m to 05h 30m, Dec. −68° 30′ to −70° 30′.

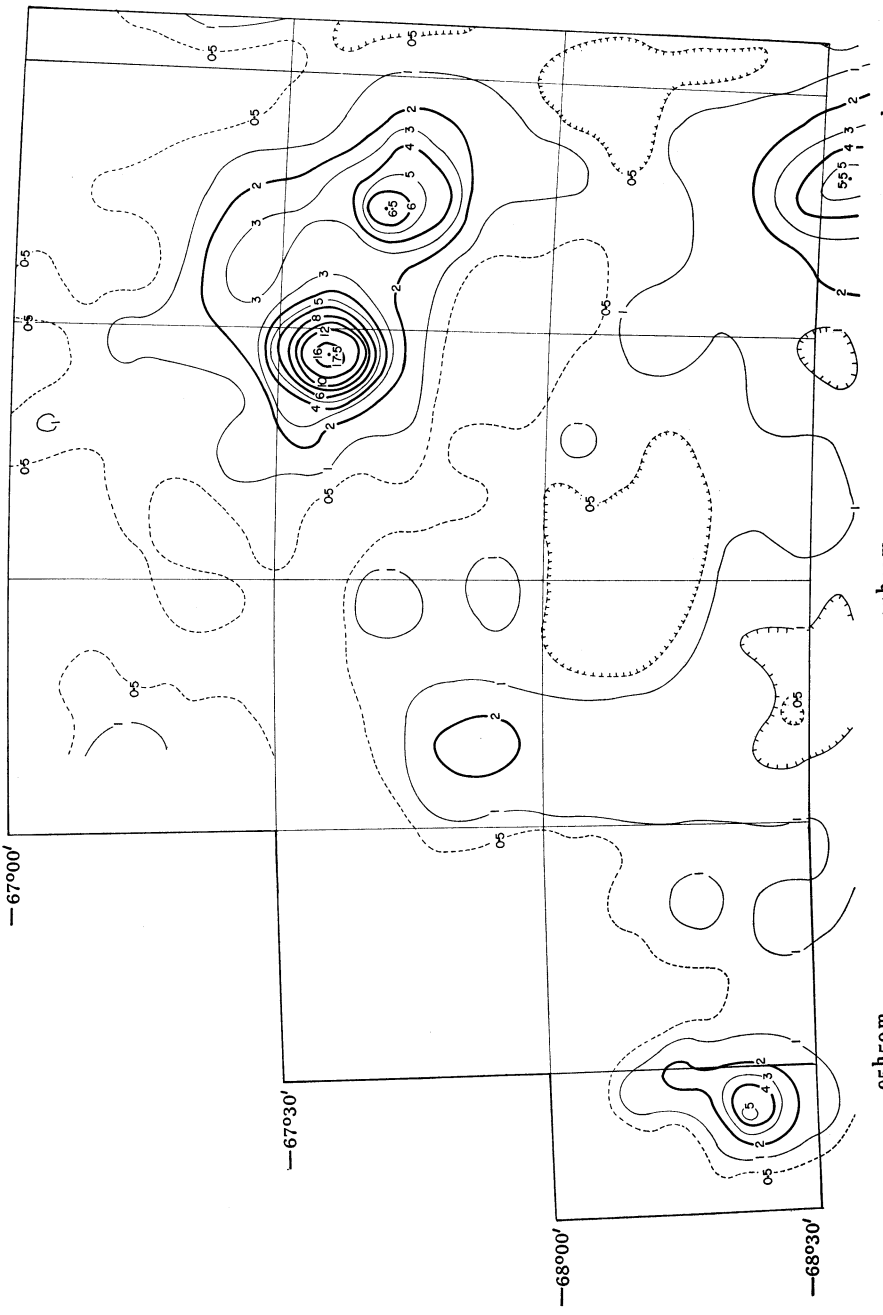

Fig. 7.—Detailed contours for the LMC, R.A. ~ 05h 30m to ~ 05h 50m, Dec. —67° 00′ to ~ —68° 30′.

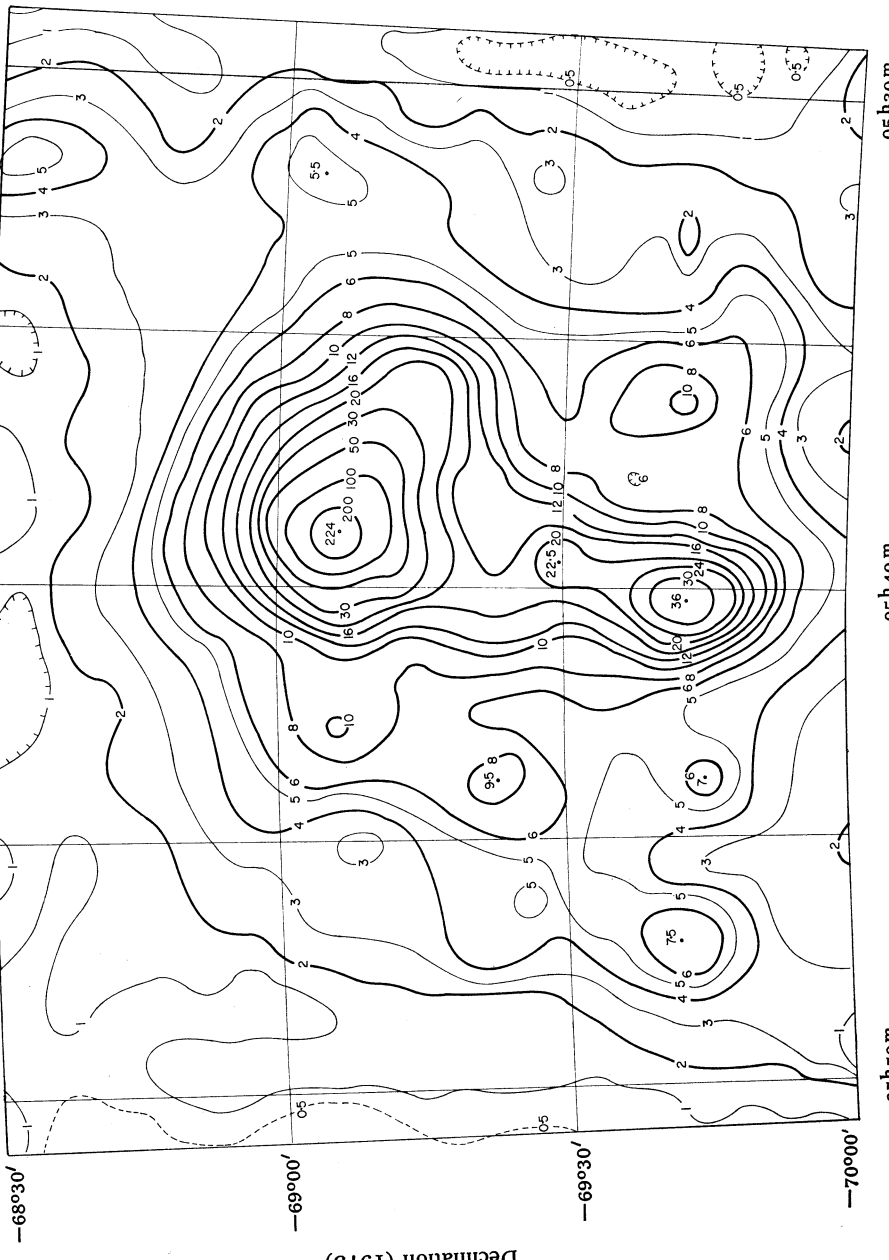

Fig. 8.—Detailed contours for the LMC, R.A. ~ 05^h30^m to ~ 05^h50^m, Dec. $-68°30'$ to $-70°00'$.

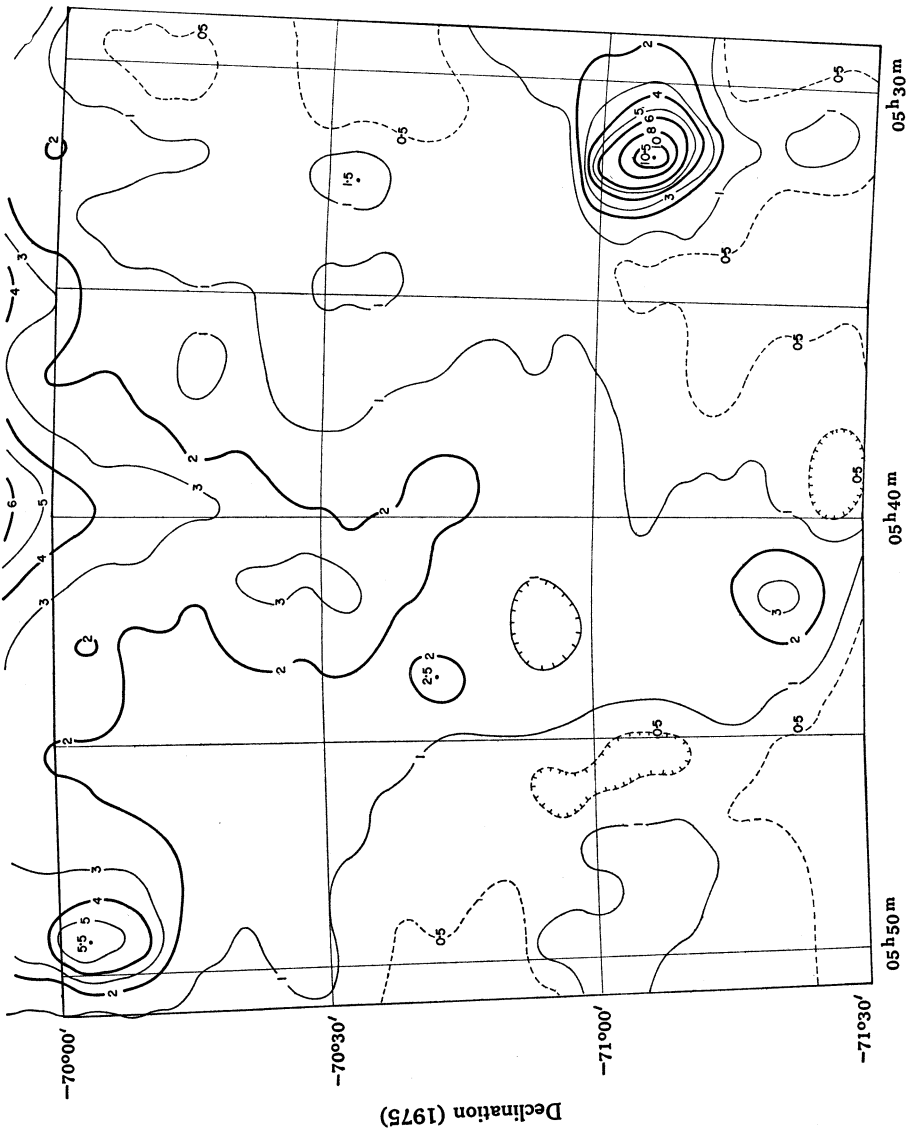

Fig. 9.—Detailed contours for the LMC, R.A. ~ 05h 30m to ~ 05h 50m, Dec. ~ −70° 00′ to −71° 30′.

Fig. 10.—General disposition of the important sources in the SMC.

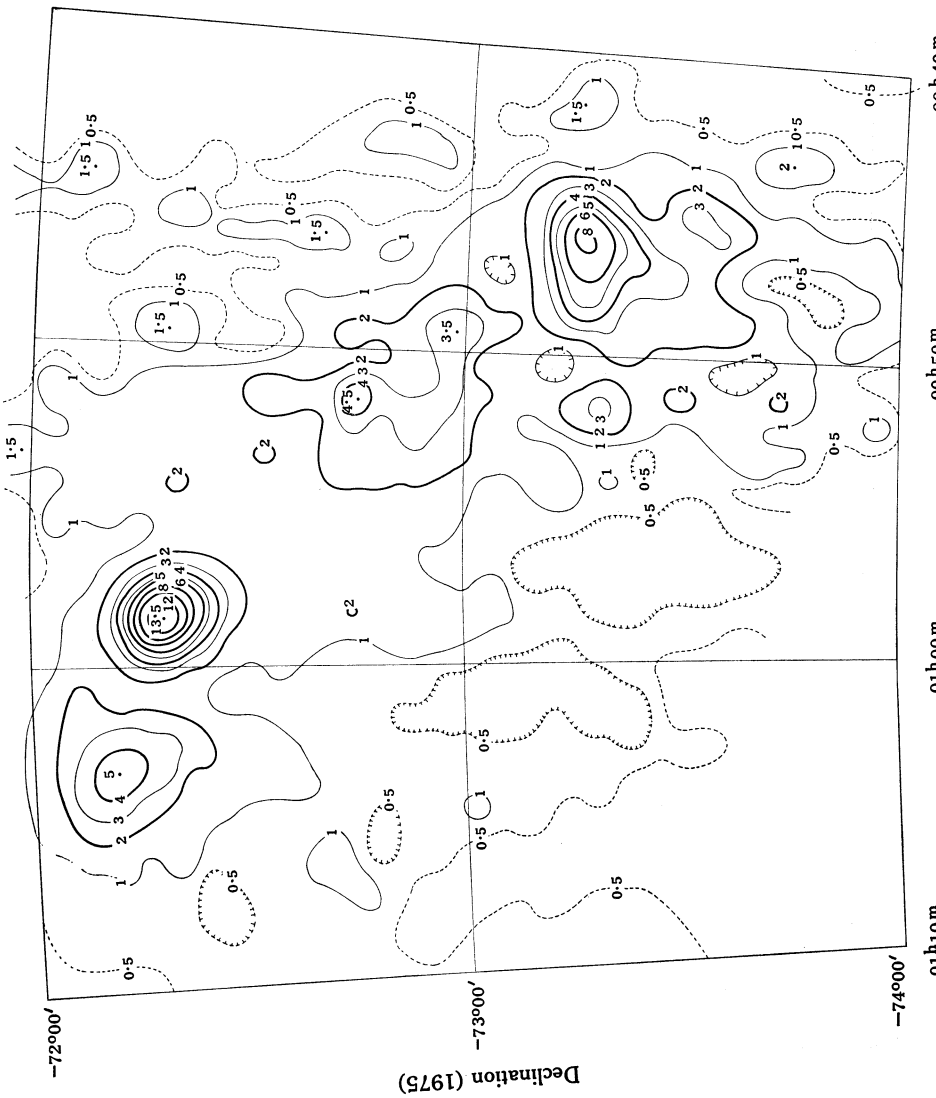

Fig. 11.—Detailed contours for the SMC in the vicinity of the bar.

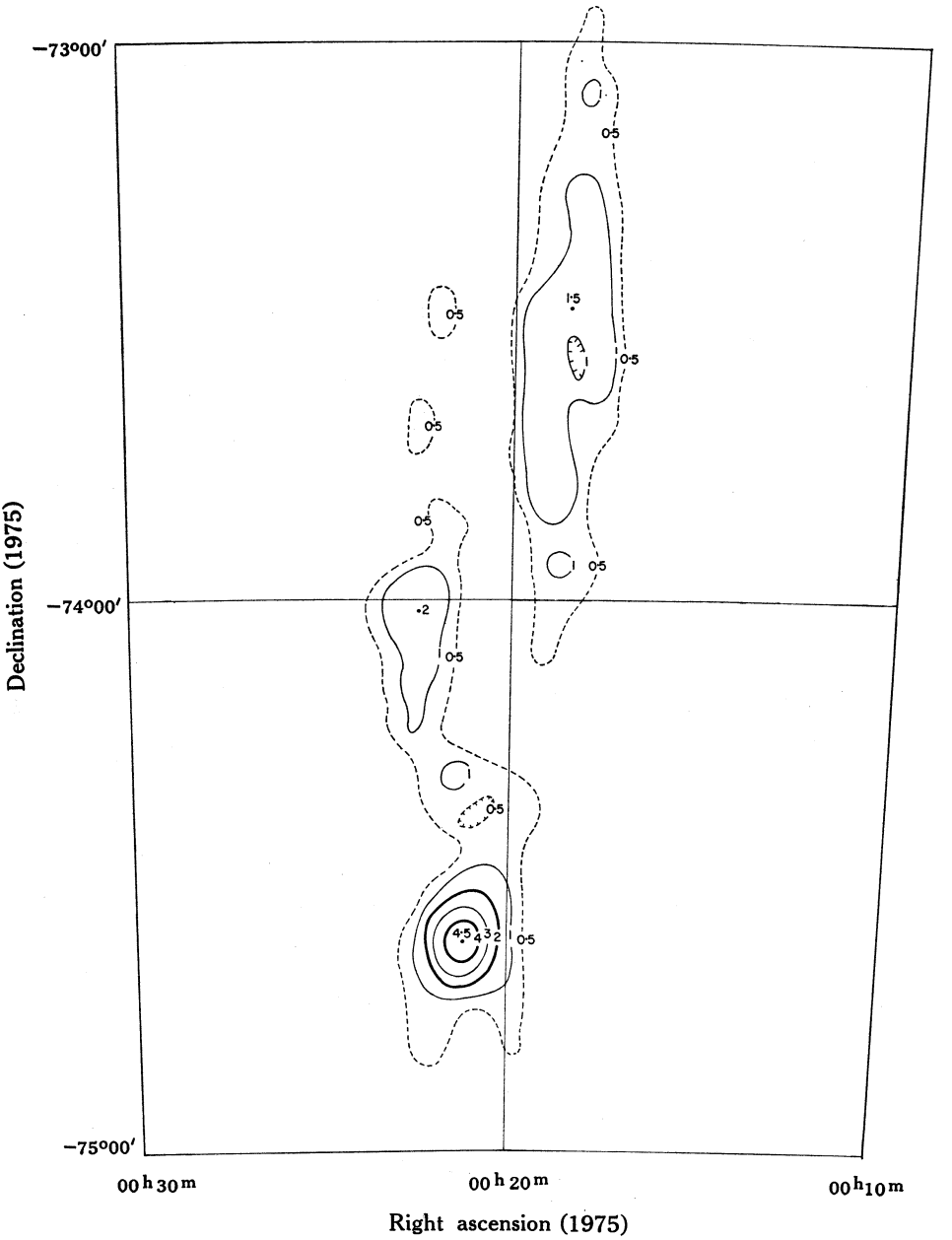

Fig. 12.—Detailed contours of additional radiation from the SMC situated some distance south-west from the bar.