A LOW LATITUDE SURVEY FROM $l^{II} = 27°$ TO 38° AT 1410 AND 2650 MHz

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[*Manuscript received September* 5, 1968]

Summary

This paper presents contour maps of a region of the Milky Way at 1410 and 2650 MHz. A list of sources with values of flux densities and peak temperatures is given.

I. Introduction

The area covered in this paper is the first section of an extensive survey of continuum radiation from low latitudes (−2° to +2°), using the Parkes 210 ft telescope. The full survey is mainly concerned with a 2650 MHz study of the Southern Milky Way, but it was decided to begin with the northern region $l^{II} = 27°$ to 38°, for comparison with 21 cm line observations in the same region, which is the presumed tangential direction of the Scutum spiral arm. At the present time the 2650 MHz survey has been completed between longitudes 280° and 27° and additional maps are being prepared.

The observations included in this paper were carried out in July and September 1965 and have been computer processed as described by Beard (1966). A source list with estimates of flux density, peak temperature, and notes on optical identifications has been compiled.

II. Equipment and Observing Procedure

The equipment and the observing and calibration procedures used were the same as described by Beard and Kerr (1966). Table 1 summarizes the equipment

Table 1

PARAMETERS OF RECEIVER AND CALIBRATION SOURCES

Parameter	Frequency (MHz) 1410	2650
Receiver		
type	Parametric	Parametric
bandwidth (MHz)	10	100
system noise temperature (°K)	105	180
time constant (sec)	1	0·5
Beamwidth at half intensity (min of arc)	14·0	7·4
Full-beam solid angle (sr)	$1\cdot83\times10^{-5}$	$5\cdot15\times10^{-6}$
Reference source	3C 327	19−46
Flux density of reference source (W m^{-2} Hz^{-1})	8·5	7·1
Flux density/T_b for point source	1·1	1·1
Scan rate (deg min^{-1})	1	1

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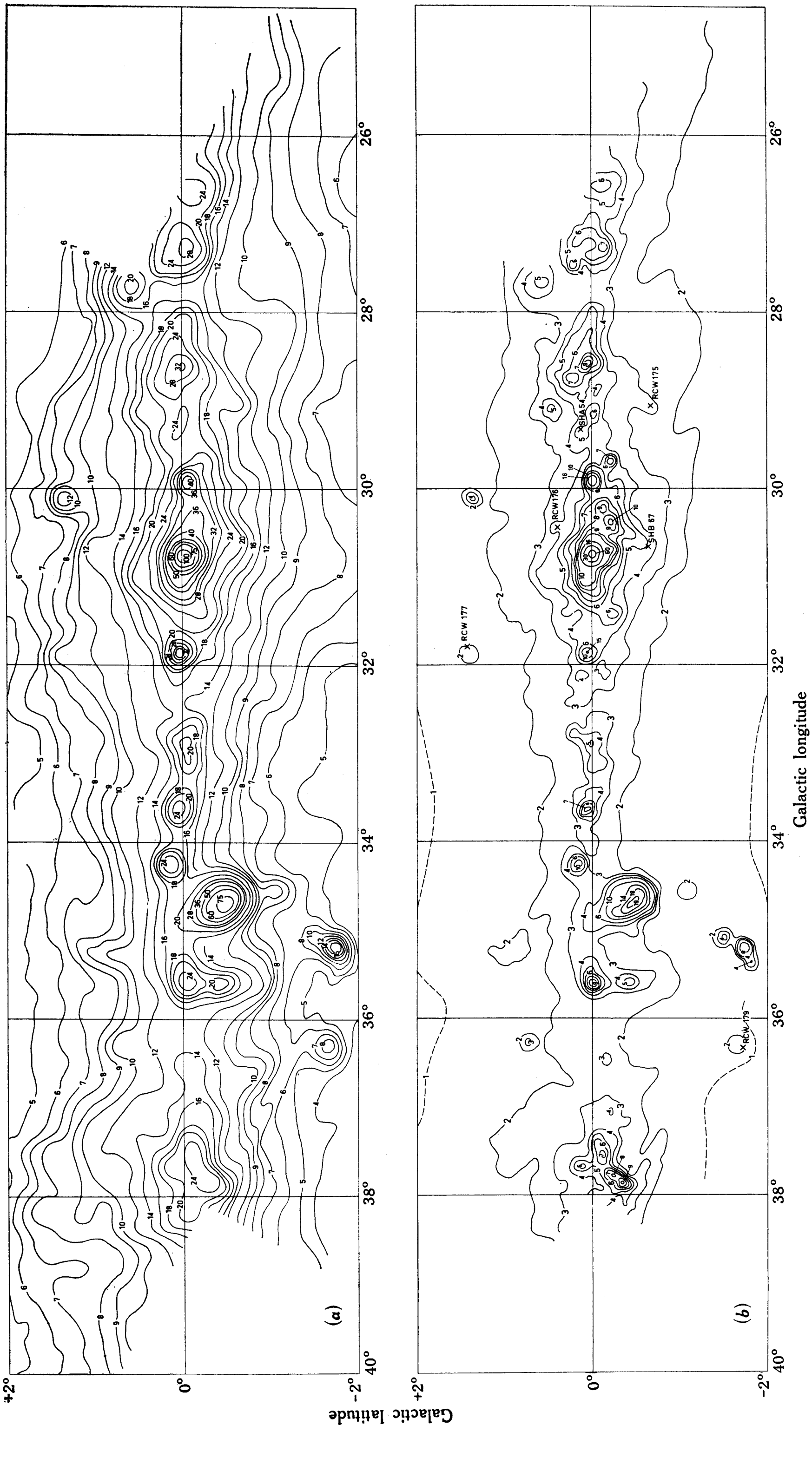
(a)
(b)
Galactic latitude
Galactic longitude
+2°
0°
-2°
26°
28°
30°
32°
34°
36°
38°
40°
RCW 175
RCW 176
RCW 177
RCW 179
SHA 54
SHB 67

Fig. 1

parameters and gives the flux densities assumed for the two reference sources. As described in the above paper, the baselevels for the individual declination scans were related through a number of scans in right ascension at fixed declinations near the northern and southern ends of the area surveyed. These reference scans were related to the temperature at the south celestial pole, which was assumed to be zero. Allowance was made for the zenith angle effect.

III. Results

The contours obtained at the two frequencies are shown in Figure 1. One contour unit corresponds to 1·1 degK in brightness temperature at 1410 MHz and 1·0 degK at 2650 MHz. Figure 1 also shows the positions of visible nebulae in relation to the 2650 MHz contours. The Palomar plates were studied, but heavy obscuration prevents the possibility of optical identification over a large part of the area surveyed. Most of the sources in this longitude region are believed to be at large distances, in the Scutum and Sagittarius arms.

Table 2 presents the list of sources derived from the 2650 MHz contours. Column 1 gives the source number from previous surveys (Westerhout 1958 or Bennett 1962). Column 2 gives the catalogue number using the galactic system introduced by Mezger and Henderson (1967). Columns 3–6 give the source position coordinates in $l^{\mathrm{II}}, b^{\mathrm{II}}$ and in 1950·0 right ascension and declination. Column 7 gives the approximate source diameter derived from the measured half-power width and the known aerial beamwidth. Column 8 gives the background level used to derive the peak brightness temperature, half-width, and integrated flux density. In the case of point sources, the flux density was calculated directly from the peak brightness temperature above the background compared with that of the reference source. For the irregular sources, the integrated flux densities were found from planimeter measurements of contour areas. The results are subject to large uncertainties where sources overlap. The derivation of flux densities for many of the sources in the list is admittedly rather subjective, but an attempt has been made to use a consistent procedure throughout. The estimated flux densities for the two frequencies are given in columns 10 and 11. Column 12 gives the nebula reference number quoted in papers by Sharpless (1953) (SHA), Sharpless (1959) (SHB), or Rodgers, Campbell, and Whiteoak (1960) (RCW).

There are several nonthermal sources in the region. The source W 44 is the well-known supernova remnant, and 3C 391 has been classed as nonthermal by Large, Mathewson, and Haslam (1961).

The other sources noted as nonthermal need additional examination. Convolution of the 2650 MHz survey to a beamwidth corresponding to the 1410 MHz survey has supported the evidence of the flux ratios given and also indicates source G33·6+0·1 as being nonthermal.

Fig. 1.—Isophotes of the Milky Way at:

(*a*) 1410 MHz. One contour unit equals 1·1 degK in brightness temperature. Aerial beamwidth was 14′·0 at half-power points.

(*b*) 2650 MHz. One contour unit equals 1·0 degK in brightness temperature. Aerial beamwidth was 7′·4 at half-power points. RCW, SHA, and SHB numbers refer to nebulae (see Section III and Table 2).

Table 2

SOURCES DERIVED FROM 2650 MHz CONTOURS

(1) Other Ref. No.	(2) Catalogue Number	(3) Galactic Coords l^{II} ° ′	(4) b^{II} ° ′	(5) Position (1950·0) R.A. h m s	(6) Dec. ° ′	(7) Half-power Width ′	(8) Back-ground Level (°K)	(9) Peak Bright. Temp. (°K)	(10) Flux Density (10^{-26} W m^{-2} Hz^{-1}) 11 cm	(11) 20 cm	(12) Optical Identi-fication	(13) Remarks
	G26·6−0·1	26 36	−0 8	18 37 39	−5 45	11	5·0	6·6	5	3·5		
3C 387	G27·3−0·1	27 17	−0 9	18 38 59	−5 8	8	4·0	7·6	7·5			
	G27·5+0·2	27 29	0 11	18 38 9	−4 49	5	4·0	6·6	3			
	G27·7+0·5	27 41	0 33	18 37 16	−4 28	9	4·0	5·5	3	3·5		
	G28·6+0·0	28 36	0 2	18 40 46	−3 53	7	5·0	9·5	8			
	G28·8+0·2	28 46	0 12	18 40 28	−3 40	7	5·0	7·9	6			
	G29·0−0·6	29 1	−0 34	18 43 39	−3 48		3·5	4·2			RCW 175	Filamentary nebula 7′ diam.
	G29·1+0·4	29 7	0 27	18 40 13	−3 15		3·5	5·5	2·5			
	G29·2−0·0	29 11	−0 2	18 42 4	−3 24		3·5	6·3	3			
	G29·4+0·1	29 23	0 6	18 41 58	−3 10	5	4·0	5·9	3		SHA 54	Faint nebula 25′ diam.
	G29·7−0·2	29 42	−0 13	18 43 43	−3 1		4·0	8·0	3·5			
	G29·9−0·0	29 56	−0 1	18 43 26	−2 44		3·5	21·0	19	18		
	G30·1+1·3	30 7	1 21	18 38 55	−1 56		2·0	4·3	2	6		Nonthermal?
	G30·2−0·1	30 14	−0 8	18 44 25	−2 31		6·5	9·5	3·5			
	G30·4−0·2	30 24	−0 13	18 45 00	−2 25	7	6·5	10·3	8·5			
	G30·4+0·4	30 27	0 23	18 42 55	−2 5		4·0	4·8			RCW 176	Medium brightness nebula 10′ diam.
	G30·6−0·6	30 38	−0 34	18 46 39	−2 22						SHB 67	Faint nebula 10′ diam.
W 43	G30·7−0·0	30 45	−0 1	18 44 54	−2 1	5	7·0	74·0	130	141		
	G31·0+0·0	31 3	0 3	18 45 12	−1 43	13	5·0	12·0	37			
	G31·0+0·5	31 2	0 29	18 43 40	−1 31		4·0	5·7	1·5			
	G31·4−0·2	31 26	−0 15	18 46 58	−1 31		5·0	6·8	2			

3C 391	G31·9+0·0	31	52	0	2	18	46	46	−0	59		4·0	15·7	11	19		Nonthermal
	G31·9+1·4	31	52	1	25	18	41	55	−0	21		2·0	2·6			RCW 177	Medium brightness nebula 10′ diam.
	G32·1−0·1	32	4	−0	8	18	47	43	−0	53		3·0	3·9				
	G32·1−0·7	32	8	0	7	18	46	58	−0	43		3·3	4·6	1·5			
	G32·7−0·1	32	41	−0	7	18	48	50	−0	20		3·0	4·3	2			
	G32·8+0·2	32	47	0	12	18	47	54	−0	6		3·0	5·0	1·5			
	G32·9+0·0	32	54	0	0	18	48	48	−0	5		3·0	5·2	6			
	G33·1−0·1	33	8	−0	3	18	49	25	+0	5	7	3·0	5·6	5·5			
	G33·6+0·1	33	39	0	3	18	50	0	0	36	5	3·0	7·3	8	9·5		Nonthermal?
	G34·3+0·2	34	16	0	10	18	50	46	1	12		3·0	13·3	11	15		
	G34·6−1·1	34	34	−1	5	18	55	43	0	53	8	2·0	2·6				
W 44	G34·7−0·4	34	43	−0	27	18	53	48	1	18				170	227		Type II supernova remnant. Nonthermal
	G35·1−1·5	35	5	−1	30	18	58	11	1	9		2·0	4·3	2·5			
W 48	G35·2−1·7	35	12	−1	44	18	59	13	1	9		2·0	14·6	13	14		
	G35·4−1·8	35	22	−1	49	18	59	47	1	16		2·0	4·2	2·5			
	G35·6−0·4	35	36	−0	26	18	55	18	2	6	7	3·0	5·5	5	17		Nonthermal
	G35·6−0·0	35	37	−0	0	18	53	50	2	19	9	3·0	8·8	15	20		
	G36·3−1·6	36	17	−1	39	19	0	54	2	10				<1	4·5	RCW 179	Faint nebula 15′ diam.
	G36·3+0·7	36	17	0	43	18	52	29	3	15		2·5	3·5				
	G36·5−0·2	36	28	−0	10	18	55	59	3	0		3·0	3·5				
	G37·1−0·2	37	4	−0	13	18	57	15	3	30							
	G37·5−0·1	37	32	−0	6	18	57	45	3	59	8	3·0	7·3	10·5			
	G37·7+0·1	37	41	0	7	18	57	12	4	12	6	4·0	6·3	3			
	G37·8−0·2	37	47	−0	14	18	58	39	4	8		5·0	8·1	3·5			
W 47	G37·9−0·3	37	51	−0	20	18	59	9	4	10		5·0	9·3	4			

IV. Acknowledgment

Thanks are due to Miss M. Fisher for assistance with the running of the computer programmes.

V. References

Beard, M. (1966).—*Aust. J. Phys.* **19**, 141–6.

Beard, M., and Kerr, F. J. (1966).—*Aust. J. Phys.* **19**, 875–81.

Bennett, A. S. (1962).—*Mem. R. astr. Soc.* **68**, 163–72.

Large, M. I., Mathewson, D. S., and Haslam, C. G. T. (1961).—*Mon. Not. R. astr. Soc.* **123**, 113–22.

Mezger, P. G., and Henderson, A. P. (1967).—*Astrophys. J.* **147**, 471–89.

Rodgers, A. W., Campbell, C. T., and Whiteoak, J. B. (1960).—*Mon. Not. R. astr. Soc.* **121**, 103–10.

Sharpless, S. (1953).—*Astrophys. J.* **118**, 362–9.

Sharpless, S. (1959).—*Astrophys. J. Suppl. Ser.* **4**, 257–79.

Westerhout, G. (1958).—*Bull. astr. Insts Neth.* **14**, 215–60.