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THE 5 GHz STRONG SOURCE SURVEYS. IV. SURVEY OF THE AREA BETWEEN DECLINATION 35 AND 70 DEGREES AND SUMMARY OF SOURCE COUNTS, SPECTRA AND OPTICAL IDENTIFICATIONS

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ABSTRACT

A new zone (S4) has been surveyed at 5 GHz and is essentially complete above 0.5 Jy. A total of 269 sources above this flux density were found in an area of 1.71 sr between declinations of 35° and 70°. Accurate flux densities at 2.7, 5.0, and 10.7 GHz are given, together with source coordinates accurate to between 1 and 5 arcsec, and proposed optical identifications. Sources below the completeness limit are also listed, giving a catalog of 484 sources. The results of the S4 survey are combined with those of the previous 5 GHz surveys, with a 5 GHz strong source sample derived from the Parkes 2.7 GHz surveys, and with samples taken from deeper surveys made at 5 GHz to discuss the source counts, the source spectra and their relation to the optical identifications. The 5 GHz source counts differ from those derived at lower frequencies in that there is less evidence for either a steepening of the counts at high flux densities or for their convergence at very low flux densities. The counts indicate a possible anisotropy related to the supergalactic system.

I. INTRODUCTION

Since 1968, a number of surveys made at a frequency of 5 GHz ($\lambda = 6$ cm) have been reported. These include the Strong Source or S surveys, namely the **S1** survey (Kellermann *et al.* 1968b), which was complete to 0.8 Jy, and the **S2** and **S3** surveys (Pauliny-Toth *et al.* 1972; Pauliny-Toth and Kellermann 1972b), both of which were complete to 0.6 Jy. All three surveys were made with the 43-m telescope of the National Radio Astronomy Observatory (NRAO).

This paper presents the results of the new **S4** survey, which covers the region between declinations of 35° and 70°. The finding survey, described in Sec. II, was made with the 92-m transit telescope of the NRAO. As discussed in Sec. III, those sources detected in the finding survey which have galactic latitude $|b| \geq 10°$ were reobserved with the 100-m telescope of the Max-Planck Institut für Radioastronomie at 4.9, 2.7, and 10.7 GHz in order to determine accurate flux densities at these frequencies, and the radio spectra of the sources. These measurements gave radio positions accurate to a few seconds at arc; for about one-third of the sources stronger than 0.5 Jy at 5 GHz, positions accurate to about 1 arcsec were available in the literature; for a further third, positions have been measured with the NRAO interferometer to an accuracy of about 1 arcsec. Optical identifications have been attempted for all sources above this flux density limit (Kühr 1977; in preparation). The source counts and spectral index distribution are discussed in Sec. IV.

Flux densities have also been measured at 31.4 GHz with the NRAO 11-m telescope for all sources with flat spectra and flux densities greater than 1 Jy at 5 GHz. These measurements are reported in a separate paper (Witzel *et al.* 1978).

II. THE FINDING SURVEY

The survey instrument was the 92-m telescope, equipped with a cooled parametric amplifier giving a system noise temperature of about 160 K and a bandwidth of 150 MHz centered at 5000 MHz. Beam switching was used, with a 7.2 arcmin separation of the two beams, each of which had a half-power beamwidth (HPBW) of 2.7 arcmin. The observations, which were

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made in March and April 1972, consisted of scans in declination, made by combining the 10°/min slew rate of the transit telescope with a sidereal tracking motion of the feeds and radiometer. At this rate, a source was within the half-power points of the beam for about 0.3 s. The declination range was broken into three overlapping declination zones, in order to shorten the scans and thus limit the lateral offset of the feeds from the paraboloid axis to less than 2 HPBW. Each scan lasted about 1 min, and after its completion, the feed enclosure was reset to its initial position and the slewing was reversed. The telescope motion and the data recording, made at a rate of 10 samples/sec, were under computer control. The line joining the two beams was oriented in P.A. 11°, so that they were separated by 1.35 arcmin (0.5 HPBW) in the East–West direction during each scan.

One day's observation produced an open pattern of scans on the sky with a separation of several beamwidths between scans. These gaps were filled on successive days by repeating the observations, but with each scan offset in right ascension by one HPBW. After 5 or 6 days of observation (depending on the declination zone), each zone was thus covered completely by the interleaved scans, with a spacing of ≤0.5 HPBW between the tracks of one or the other beam. The beam switching, combined with the high-scan rate, was highly effective in reducing the amount of time lost to bad weather. Scans which were unacceptable for one reason or another were repeated later, so that good data were available for the entire survey area between declinations of 35° and 70° (1950.0) except for two small gaps (both at $|b| < 10°$).

The survey data were reduced to a source list as follows. After conversion of the data to calibrated antenna temperatures, a baseline consisting of a running mean taken over a range of 20 HPBW was subtracted from the data in order to remove large-scale structure. The change in baseline was very small and repeatable for all scans in a given declination zone, and was due primarily to variations in the thermal radiation from the ground picked up by the feed horns. After the baseline removal, data exceeding 0.17 K antenna temperature, or 2.7 times the rms noise σ, in absolute value were stored on a magnetic tape for further processing.

Most of the points thus extracted were still attributable to receiver noise. In a further step, each datum in excess of 3.5σ was located and was used, together with neighboring data in excess of 3σ, to compute the approximate flux density and centroid position of each source. Single, isolated points were rejected, as well as sources with computed peak antenna temperatures below 0.25 K. The flux density corresponding to this antenna temperature, i.e., the cutoff flux density of the finding survey, is a function of the zenith angle z for the 92-m telescope. This function is shown in Fig. 1 and it can be seen that the cutoff flux density increases from 0.3 Jy at $z = 0$ ($\delta = 38\overset{\circ}{.}4$) to 0.65 Jy at $z = 32°$($\delta = 70\overset{\circ}{.}4$).

Several critical parameters in the data reduction were directed towards a high completeness of the finding list, at the expense of accepting a small fraction of spurious sources. In particular, data lying as much as 4 arcmin from the maximum were included as part of the source, to reduce the selection against extended sources. Later reobservation of each source in finding list, as described in Sec. III, permitted the removal of the spurious sources and gave accurate positions and flux densities for the real sources.

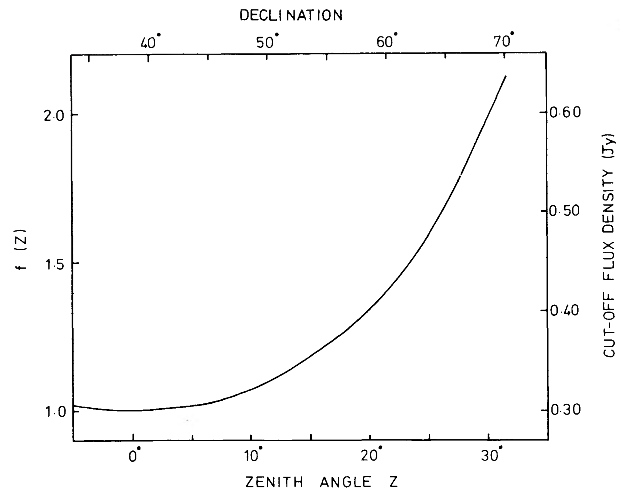

FIG. 1. The function $f(z)$ is the ratio of the antenna temperature for a given flux density at the zenith to that observed at the zenith angle z, for the 92-m telescope. The declination corresponding to z, and the cut-off flux density of the finding survey corresponding to $f(z)$ are also given.

III. REOBSERVATION OF THE SOURCES

A. Measurements with the 100-m Telescope

Those sources in the finding list lying more than 10° from the galactic plane were observed with the 100-m telescope at frequencies of 2.7, 10.7, and 4.9 GHz. Most of the these observations were made in August 1972, December 1972, and December 1974, respectively. The characteristics of the receivers, all of which used cooled parametric amplifiers mounted at the prime focus of the antenna, and of the feed systems are summarized in Table I.

All three receivers were used in a Dicke-switched mode. At 2.7 GHz the difference in the power received from the feed horn and a cooled reference load was measured. At the two higher frequencies, the difference in the power received from the two feed horns was measured. In each case, a continuous calibration was provided by an internal noise signal which was added to the signal coming from one feed during every alternate switch cycle. The pointing of the telescope and the adjustments required to keep the feed system at the focal point were under computer control. The observations were made by means of scans, generally about 4 HPBW

TABLE I. Receiver and feed characteristics for the 100-m telescope.

Center frequency (GHz)	System noise (K)	Band width (MHz)	Feed system and polarization	Beam separation (arcmin)	HPBW (arcmin)	rms noise in 1 s (Jy)
2.695	100	40	Single horn, linearly polarized	...	4.85	0.02
4.900	90	250	Two horns, each linearly polarized,	6.2	2.6	0.006
10.690	150	40	E-vectors orthogonal	3.5	1.3	0.05

in length, along two orthogonal directions through the given source position, and the data were taken at a rate chosen to give about four independent points per HPBW. Observations of sources of small angular size, with accurately known radio positions, were made in the same manner at intervals of 1–2 h, to calibrate the residual pointing errors of the telescope and observations of several sources believed to be nonvariable were made several times per day to calibrate the data in terms of flux density. The procedure differed in detail at the three frequencies:

(a) At 2.7 GHz, the scans were made in the azimuth and elevation coordinates at a rate of 30 arcmin/min. Typically two or four scans were made in each coordinate, the number depending on the strength of the source. Because the position angle of the feed was not under computer control when these observations were made, each source was observed twice: once with the *E*-vector of the feed in the vertical plane and at the same sidereal time on a later day, with the feed rotated by 90°.

(b) At 4.9 GHz, the feed assembly was rotated under computer control so that the line joining the beam centers was in P.A. 45°. Two or four scans were made across the source in right ascension and declination at a rate of 30 arcmin/min with each of the two orthogonally polarized beams.

(c) At 10.7 GHz, the feed assembly was rotated so that the line joining the feed centers was oriented at 45° to the elevation direction. Scans were then made across the source in azimuth and elevation at a rate of 20 arcmin/min with each of the two orthogonally polarized beams. Four or eight scans were made across the source with each beam.

The subsequent reduction procedure was similar to that described elsewhere (Pauliny-Toth *et al.* 1974) and involved

(a) subtracting a linear baseline from the data in each scan,

(b) normalizing the data to the internal noise signal,

(c) averaging, for each beam, or each polarization, of the scans made in a given coordinate,

(d) fitting Gaussian functions to the averaged data in each coordinate, to give the peak response, the half-power width in the two coordinates and the position of the peak, together with their standard errors; and, finally

(e) averaging the results of the Gaussian fitting, for the data taken in each of the two orthogonal polarizations.

This procedure gave, for each source, a peak response and an integrated response, that is, the product of the peak response and the half-power widths in the two coordinates. These values were converted to flux densities as follows:

First, the data were corrected for the dependence of the gain of the antenna and of the atmospheric extinction on elevation angle. These corrections were small, the largest being about 5% at 10.7 GHz. Second, the observations of the standard sources were used to determine the flux-density scaling factors, both for the peak and for the integrated responses. For each source, a peak and an integrated flux density were then available. For subsequent work, peak flux densities were used, unless the integrated flux density exceeded the peak flux density by more than the sum of the respective errors, as given in Sec. III *b*.

For the calibration of the flux-density scales, data for three of the standard sources, 3C 123, 3C 147, and 3C 295 were taken from Kellermann *et al.* (1969; hereafter KPW) for the 2.7- and 4.9-GHz observations. For the latter frequency, the 5.0-GHz flux densities given in KPW were adjusted to 4.9 GHz, using the spectral index computed from the KPW 2.7- and 5.0-GHz flux densities. At 10.7 GHz, the calibration data were taken from Kellermann and Pauliny-Toth (1973). Once the spectral indices of the sources in the survey list had been determined, they were used to correct the measured 4.9-GHz flux densities to 5.0 GHz, for consistency with the previous S surveys.

b) *Flux-Density Errors*

At each frequency, some sources, including the calibrators, were observed more than once so that the repeatability of the measured flux densities could be determined. The rms error of a single measurement of a source of flux density *S* (Jy) can be represented by

$$\sigma_m = [(\sigma_n)^2 + (\sigma_g S)^2]^{1/2}\text{Jy},$$

where σ_n is the error due to receiver noise and to fluctuations in the atmospheric emission, while σ_g represents the uncertainty due to changes in the atmospheric extinction, in the gain of the antenna and in that of a radiometer. The values of σ_n and σ_g were determined both for the peak and for the integrated flux densities and are given in Table II.

TABLE II. Contributions to the flux density errors due to noise (σ_n), receiver or antenna gain variations (σ_g) and confusion (σ_c). Values in parentheses apply to the integrated flux densities.

Frequency GHz	σ_n mJy	σ_g %	σ_c mJy
2.695	9 (27)	0.8 (0.6)	9
4.9	6 (7)	1.1 (1.2)	2
10.69	37 (78)	1.8 (1.5)	...

The uncertainty due to confusion from unresolved sources in one or the other beam is small. At 2.7 GHz the resulting additional error σ_c is estimated to be 9 mJy (Pauliny-Toth *et al.* 1974). At 5.0 GHz; deep surveys made with the 100-m telescope (unpublished) indicate that σ_c is about 2 mJy; at 10.7 GHz the effect of confusion is negligible.

The total random errors in the flux densities are thus

$$\sigma_s = [(\sigma_m)^2 + (\sigma_c)^2]^{1/2}\text{Jy}.$$

The typical error for a source having $S = 0.5$ Jy is thus about 2.5%, 1.5%, and 8% at 2.7, 5.0, and 10.7 GHz, respectively.

The absolute scale of flux densities is that of KPW at 2.7 and 5.0 GHz and that of Kellermann and Pauliny-Toth (1973) at 10.7 GHz. These scales agree to within 3% with a new, absolute scale of flux densities derived by Baars *et al.* (1977).

c) *Source Positions*

The most reliable source positions obtained from the 100-m observations were those measured at 2.7 GHz. This was partly due to frequent observations of calibration sources and partly because the feed assembly was not rotated between the observations of the sources and calibrators so that errors due to any misalignment of the axis of rotation and of the electrical axis of the antenna were absent. Each source was observed on two different days at this frequency, as described in Sec. III *b*. A comparison of the two sets of positions showed that the standard position error in each coordinate, for a source of flux density S Jy at 2.7 GHz was given by

$$\sigma_p = \left[\left(\frac{1.1}{\text{S}}\right)^2 + (3.3)^2\right]^{1/2}\text{arcsec}.$$

For a sample of 109 sources in the list, positions were also obtained with the NRAO three-element interferometer at frequencies of 2.7 and 8.1 GHz (for 17 of these, the measurements were kindly made by J. Condon). Interferometer spacings of 200, 1900, and 2100 m were used to make two to three observations of each source at different hour angles. These measurements gave positions with an accuracy of 1 arcsec in each coordinate. A comparison of the interferometer positions with the 100-m positions gave a distribution of differences having a dispersion of 3.5 arcsec, consistent with the above errors.

In the case of some sources, most of which were below the completeness limit of the survey, only a position derived from the 5-GHz data was available. The accuracy of these positions, estimated from repeated observations, is about ±5 arcsec.

d) *Completeness of the Survey*

The completeness of the survey is determined by three effects:

(a) The completeness of the finding survey, for which the lower cutoff in flux density was a function of the declination (Sec. II).

(b) The effect of any secular variation of the sources, during the long-time interval (2½ yr) between the time of the finding survey and the reobservation of the sources at 5 GHz.

(c) Errors in the measured flux densities. The effect of confusion on the completeness is negligible, since the density of sources is low, even at the survey limit.

The completeness was estimated in a manner similar to that used for the earlier **S** surveys, by comparing the 5-GHz flux densities S_m measured with the 100-m telescope, with the flux densities S_f obtained from the finding survey. The distribution of the differences $\Delta S = S_m - S_f$ had a dispersion

$$\sigma_{\Delta S} = \{[0.085f(z)]^2 + (0.10S_m)^2\}^{1/2}\text{Jy},$$

where the first term is due primarily to errors in the flux densities from the finding survey. The contribution of this term to $\sigma_{\Delta S}$ varies with the zenith angle z (i.e., with declination) according to the function $f(z)$ shown in Fig. 1. The second term is due to a combination of errors proportional to the flux density in the finding survey data and of any secular variations of the sources. Since the finding survey was cut off at a level corresponding to a flux density $S_{\text{lim}} = 0.3f(z)$, it was possible to calculate the fraction of sources having a given value of S_m which would have $S_f < S_{\text{lim}}$ and would thus have been excluded from the finding list.

The calculation showed that the final source list, based on the 100-m flux densities S_m, is 99% complete above 0.6 Jy and 96.5% complete at 0.5 Jy, corresponding to about seven missing sources in the interval 0.5–0.6 Jy and two missing sources between 0.6 and 0.7 Jy. Between 0.4 and 0.5 Jy, the survey is seriously incomplete at the higher declinations; in the range of declinations 35°–55°, however, only 11%, or about seven sources should be missing. The present survey thus achieves the same level of completeness above 0.5 Jy as the earlier **S** surveys did above 0.6 Jy. Over the restricted range of declination 35° to 55°, the same level of completeness is achieved above 0.4 Jy. Within the statistical uncertainties, the calculated numbers of missing sources are consistent with those actually found: from a sample of 105 known sources in the survey region, having flux densities at 5 GHz above 0.5 Jy, 102 were detected in the survey, while the above analysis predicts 101 detections. Above 0.6 Jy, of 94

TABLE III. The 5-GHz strong source survey

NAME	POSITION(1950.0) R.A.	DEC.		GAL LAT	FLUX DENSITIES S6	S11	S3	SPECTRAL INDICES 11-6	ERR	6-3	ERR	OPT ID	NOTES	OTHER CATALOGUES
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
0003+38	00 03 22.34	38 03 33.2	NRI1	-23.7	.504	.61	.60	-.30	.09	.22	.09	*QSS		4C+38.02,OB+306,B
0010+40	00 10 54.2	40 35 01	MP11	-21.4	1.05	1.18	.78	-.19	.07	-.38	.07	*GAL		4C+40.10,DA006
0011+34	00 11 08.2	34 25 02	MP11	-27.5	.521	.87	.27	-.82	.08	-.85	.18	DB		4C+34.01,OB+318,B,NRAO012
0020+44	00 20 54.1	44 40 08	MP11	-17.6	.249	.17		.57	.27				1	
0022+39	00 22 46.9	39 03 00	RRE	-23.3	.859	.78	.91	.16	.08	.08	.07	*QSS		OA+026,B
0024+34	00 24 02.81	34 52 07.1	RRE	-27.5	.726	.88	.69	-.30	.08	-.07	.08	*QSS		OB+338,B
0026+34	00 26 34.85	34 39 57.9	RRE	-27.7	1.27	1.51	1.01	-.28	.06	-.30	.06	EF	2	OB+343,B
0031+39	00 31 32.6	39 07 45	MP11	-23.3	.416	.90		-1.24	.08				1	3C13.0,4C+39.01,OB+352,B,DA013
0035+36	00 35 04.8	36 42 39	RRE	-25.8	.429	.61		-.57	.10					4C+36.01,OB+358.2,B
0035+41	00 35 41.58	41 20 37.1	RRE	-21.2	.636	.40		.75	.13			QSS		OB+460
0040+51	00 40 18.	51 47 12.8	CAM	-10.8	4.18	6.43	2.12	-.70	.08	-.89	.07	EF	2,3	3C20.0,4C+51.02,OB+567,DA022
0042+45	00 42 13.2	45 38 47	MP11	-16.9	.234	.29		-.35	.17				1	OB+470
0048+50	00 48 04.9	50 55 45	CT21	-11.7	.760	1.28	.33	-.85	.11	-1.09	.10	*GAL	2,3	3C22.0,4C+50.04,OB+580,DA023
0100+42	01 00 51.0	42 23 12	MP11	-20.2	.210	.42		-1.12	.17				4	OC+401
0102+48	01 02 55.3	48 02 55	MP11	-14.5	.982	1.09	.75	-.18	.07	-.34	.07	EF	2,5	
0108+38	01 08 47.27	38 50 32.6	NRI1	-23.6	1.35	1.00	.86	.49	.07	-.56	.07	EF		OC+314
0109+35	01 09 25.0	35 06 24	RRE	-27.3	.378	.37		.04	.14					B
0109+49	01 09 05.7	49 12 46	30C	-13.3	.590	1.33		-1.32	.19			D	6	3C35.0,4C+39.04,OC+415,DA039
0110+49	01 10 28.3	49 32 30	MP11	-12.9	.563	.53		.09	.10			*QSS	1,2	OC+417
0115+45	01 15 03.17	45 20 38.7	CAM	-17.0	.356	.63	.15	-.93	.21	-1.13	.17		3	3C36.0,4C+45.03,OC+425
0133+47	01 33 54.9	47 36 10	MP11	-14.3	3.26	2.19		.65	.06			*QSS	1	OC+457
0152+43	01 52 25.9	43 31 14	CAM	-17.6	.545	1.05	.26	-1.06	.12	-.97	.10	*GAL	7	3C54.0,4C+43.06,OC+487.4,DA062
0157+44	01 57 32.4	44 12 36	MP11	-15.7	.386	.69		-.95	.09				1	4C+44.05,NRAO086
0201+36	02 01 56.6	36 35 01	MP11	-23.8	.334	.51		-.67	.11					4C+36.02,OD+303,B
0206+35	02 06 39.11	35 33 43.0	NRI1	-24.4	.894	1.43	.58	-.77	.07	-.57	.16	D	1,4	4C+35.03,OD+311,B
0218+35	02 18 04.09	35 42 32.0	NRI1	-23.5	1.17	1.03		.20	.07			*GAL		OD+330,B
0218+39	02 18 43.2	39 41 50	MP11	-19.7	.292	.57		-1.08	.13				1,4	4C+39.06,OD+331,B,NRAO100
0220+42	02 20 02.4	42 46 27	CAM	-15.8	3.75	6.31		-.84	.06			E	8	3C66.0,4C+42.07,DA073
0220+39	02 20 36.9	39 47 20	RRE	-19.5	.770	1.59	.31	-1.17	.14	-1.20	.12	EF	3	3C65.0,4C+39.07,OD+334,B,DA074
0223+34	02 23 09.75	34 08 01.6	RRE	-24.5	1.28	1.78	.95	-.53	.06	-.40	.06	EF	1,2	4C+34.07,OD+338,B,DA077
0224+39	02 24 00.6	39 18 16	MP11	-19.7	.265	.34		-.43	.15				1	OD+340,B
0225+41	02 25 02.6	41 58 36	MP11	-17.2	.307	.32		-.05	.16				1	
0227+44	02 27 36.7	44 48 42	MP11	-14.4	.287	.41		-.59	.13				1	OD+446
0246+42	02 46 16.0	42 52 55	MP11	-14.7	.536	.97		-.96	.08			*GAL	1,4	4C+42.08,OD+477,DA083
0247+39	02 47 05.0	39 22 12	CT21	-17.8	.657	1.11		-.85	.10			*GAL	4,9	3C73.0,4C+39.10,OD+377,B

TABLE III (*continued*)

NAME	POSITION(1950.0) R.A.	DEC.		GAL LAT	FLUX DENSITIES S6	S11	S3	SPECTRAL INDICES 11-6	ERR	6-3	ERR	OPT ID	NOTES	OTHER CATALOGUES
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
0248+43	02 48 18.53	43 02 55.8	NRI1	-14.4	1.21	.96		.38	.07			*QSS	2	
0249+38	02 49 58.8	38 23 15	MP6	-18.4	.403	.53		-.44	.11					4C+38.08,OD+383.3,B
0258+35	02 58 35.3	35 00 30	MP11	-20.5	.926	1.31	.65	-.56	.06	-.47	.08	S	1	4C+34.09,OD+397,B,DA087
0307+44	03 07 09.15	44 24 27.2	NRI1	-11.6	.733	.98		-.46	.07			*QSS	2	4C+44.07,OE+411
0309+39	03 09 12.5	39 05 16	MP11	-15.9	.728	1.12	.34	-.70	.07	-1.01	.15	GAL	1,5	4C+39.11,OE+315,B,DA094
0309+45	03 09 14.3	45 01 52	MP11	-10.8	.125	.26		-1.15	.20				1	
0309+41	03 09 44.81	41 08 48.6	NRI1	-14.1	.514	.48	.70	.11	.12	.40	.08	*GAL	4,5	NRAO128
0315+41	03 15 00.0	41 41 12	CAM	-13.1	3.53	4.87		-.52	.10			GAL	8	3C83.1,4C+41.06,OE+425
0316+41	03 16 29.58	41 19 52.1	RRE	-13.3	47.2	25.1	51.1	1.02	.05	.13	.04	E		3C84.0,4C+41.07,OE+427,DA097
0318+43	03 18 14.0	43 48 37	MP11	-11.0	.482	.66		-.51	.09				1	
0323+41	03 23 19.1	41 41 23	MP11	-12.3	.440	.78		-.92	.10				1,4	4C+41.08,OE+439,NRAO134
0326+39	03 26 06.3	39 37 12	MP11	-13.6	.500	.85		-.86	.09			E	1,4	OE+344,B
0327+40	03 27 08.1	40 51 29	MP11	-12.5	.558	.97		-.90	.07			*GAL	1	4C+40.11,OE+445
0331+39	03 31 01.2	39 11 22	MP11	-13.4	.519	.74		-.57	.08			E	1	4C+39.12,OE+352,B
0340+36	03 40 14.9	36 12 44	MP11	-14.7	.451	.33		.51	.15				1	OE+367,B
0341+38	03 41 57.6	38 18 13	MP11	-12.8	.310	.51		-.80	.11				1	4C+38.10,OE+371,B
0344+40	03 44 38.7	40 34 49	MP11	-10.7	.502	.72		-.57	.10			E	1,2,4	4C+40.12,OE+475
0357+34	03 57 39.0	34 34 33	MP11	-13.6	.389	.69		-.92	.11				1,4	4C+34.16,OE+396,B
0402+37	04 02 29.8	37 55 28	MP11	-10.5	1.15	1.47	.69	-.40	.06	-.67	.08	*GAL	1,5	4C+37.11,OF+304,B
0420+34	04 20 37.23	34 44 50.4	NRI1	-10.2	.515	.88		-.87	.12			EF	2,9	3C115,4C+34.17,OF+334.3,B
0444+63	04 44 40.63	63 27 04.2	NRI1	11.9	.505	.52	.52	-.04	.11	.05	.10	EF	2,5	
0526+55	05 26 08.2	55 00 53	MP6	11.4	.214	.32		-.66	.17					OG+544
0537+53	05 37 13.5	53 10 53	MP11	11.8	.668	.73	.81	-.15	.29	.24	.22	*QSS	2,5	
0538+49	05 38 43.50	49 49 42.9	NRI	10.3	8.18	13.0	4.14	-.75	.05	-.89	.05	QSS	3	3C147,4C+49.14,OG+465,DA186
0540+52	05 40 11.3	52 57 05	MP6	12.1	.319	.43		-.48	.13					OG+566
0554+58	05 54 51.7	58 04 08	MP6	16.3	.407	.43		-.08	.13					
0556+52	05 56 43.5	52 26 03	MP11	14.0	.219	.43		-1.09	.12				1	4C+52.11,OG+595
0600+44	06 00 56.83	44 14 10.8	NRI1	10.9	.641	.79	.48	-.34	.13	-.39	.11	EF	5,9	3C151,OH+402
0601+57	06 01 21.7	57 53 37	MP11	17.0	.474	.37		.39	.14				1	
0632+67	06 02 38.87	67 21 18.8	NRI1	20.9	1.07	.83	1.08	.41	.08	.02	.06	EF	2	
0605+48	06 05 44.46	48 04 49.0	RRE	13.4	1.35	2.30	.62	-.87	.09	-1.02	.09	GAL	3	3C153,4C+48.15,OH+409,DA197
0609+41	06 09 19.1	41 23 36	MP6	10.9	.290	.44		-.68	.13					
0611+48	06 11 15.0	48 19 59	MP11	14.3	.400	.31		.40	.16				1	
0613+54	06 13 27.2	54 05 39	MP11	17.0	.354	.64		-.95	.09				1	3C155,4C+54.09,OH+522
0620+385	06 20 02.0	38 32 25	MP11	11.5	.274	.17		.74	.27				1	OH+335,B

TABLE III (*continued*)

NAME	POSITION(1950.0) R.A.	DEC.		GAL LAT	FLUX DENSITIES S6	S11	S3	SPECTRAL INDICES 11-6	ERR	6-3	ERR	OPT ID	NOTES	OTHER CATALOGUES
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
0620+389	06 20 51.4	38 58 33	MP6	11.8	.874	.89		-.03	.08			*QSS	2	
0621+40	06 21 34.3	40 05 32	CT21	12.4	.697	1.15	.27	-.81	.09	-1.24	.10	*GAL	7	3C159,4C+40.15,B,DA206
0622+47	06 22 00.0	47 45 59	MP11	15.7	.354	.63		-.95	.09				1	
0625+50	06 25 51.8	50 30 21	MP11	17.4	.493	.76		-.71	.08			*GAL	1	4C+50.17,OH+542
0627+53	06 27 32.7	53 13 34	MP6	18.6	.425	.57		-.48	.10					OH+546
0630+49	06 30 00.6	49 46 07	MP11	17.7	.376	.32		.24	.15				1	
0636+68	06 36 47.57	68 01 27.7	NRI1	24.1	.539	.32	.43	.87	.16	-.27	.12	*QSS	2	
0639+59	06 39 38.2	59 58 21	MP11	22.4	.552	.85	.26	-.69	.08	-.98	.19	EF	2,5	
0641+39	06 41 26.1	39 17 57	MP6	15.6	.407	.44		-.14	.12					OH+368.8,B
0642+44	06 42 53.05	44 54 29.4	NRI1	17.9	.778	1.27	.90	-.79	.07	.16	.07	QSS	5	OH+471
0642+40	06 42 50.9	40 47 58	MP6	16.4	.237	.33		-.54	.16					4C+40.17,OH+470
0646+60	06 46 04.12	60 05 14.5	NRI1	23.2	.788	.69	.46	.23	.09	-.70	.11	EF	2	OH+577.1
0648+46	06 48 42.9	46 38 39	MP11	19.5	.303	.42		-.53	.12				1	
0650+37	06 50 35.29	37 09 26.0	NRI1	15.4	.971	.77	.71	.37	.08	-.40	.08	QSS	2,5	B
0653+45	06 50 45.5	45 18 18	MP6	19.4	.351	.50		-.59	.11					OH+484
0651+54	06 51 11.05	54 12 50.4	RRE	22.2	1.16	1.99	.53	-.87	.06	-1.03	.06	GAL	10	3C171,4C+54.11,OH+585,DA225
0652+42	06 52 38.2	42 41 05	MP6	18.8	.491	.67		-.51	.09					4C+42.22,OH+488
0655+40	06 55 29.0	40 18 10	MP11	18.5	.277	.45		-.78	.12				1	OH+493,B
0655+69	06 55 56.83	69 56 04.9	NRI1	25.2	.688	1.03	.32	-.65	.07	-.99	.15	EF	2	4C+69.10,DA226
0657+68	06 57 34.61	68 45 37.3	NRI1	26.2	.585	.87	.31	-.63	.08	-.83	.16	GAL	2	4C+68.07
0658+38	06 58 56.39	38 01 44.5	RRE	18.3	.437	.86	.20	-1.10	.12	-1.03	.13		7	3C173,4C+38.19,OH+398,B,DA227
0659+44	06 59 16.41	44 35 36.3	NRI1	20.6	.537	1.13	.24	-1.20	.07	-1.06	.20	EF	1,2	4C+44.15,OH+499,DA228
0700+47	07 00 26.63	47 05 25.2	NRI1	21.5	.493	.66	.34	-.46	.09	-.48	.15	EF	2	OI+401
0703+46	07 03 05.91	46 52 36.7	NRI1	21.9	.630	.99	.33	-.73	.07	-.85	.15	EF		OI+407
0703+42	07 03 11.6	42 36 41	MP11	20.6	.985	1.67	.60	-.86	.07	-.67	.17	GAL	4	4C+42.23,OI+405,DA229
0707+47	07 07 02.53	47 37 07.7	NRI1	22.8	.998	1.29	1.37	-.42	.06	.40	.05	CF	2	
0707+68	07 07 55.26	68 57 13.2	NRI1	27.1	.749	1.13	.42	-.67	.07	-.75	.12	QSS	2	4C+68.08
0710+43	07 10 03.32	43 54 26.3	NRI1	22.2	1.66	1.91	1.12	-.22	.06	-.52	.06	*QSS		OI+417
0710+45	07 10 51.1	45 45 26	MP11	22.9	.479	.74	.19	-.70	.09	-1.21	.25	EF	2	4C+45.13,OI+418.2,DA232
0711+35	07 11 05.62	35 39 52.6	NRI	19.7	1.51	1.83	.97	-.31	.06	-.57	.06	QSS	10	OI+318,B
0712+53	07 12 42.5	53 28 32	MP11	25.1	.614	.93	.35	-.66	.07	-.75	.14	*GAL		4C53.160,I+521.0
0714+45	07 14 13.8	45 43 27	MP11	23.4	.519	.42	.78	.34	.12	.53	.07	*QSS	2,5	OI+424
0716+47	07 16 40.0	47 43 14	MP11	24.4	.308	.31		-.01	.16					OI+428
0718+37	07 18 38.7	37 28 36	MP11	21.8	.130	.15		-.23	.32					
0722+39	07 22 26.3	39 23 18	MP11	23.1	.230	.48		-1.19	.12					4C+39.17,B

TABLE III (*continued*)

NAME	POSITION(1950.0) R.A.	DEC.		GAL LAT	FLUX DENSITIES S6	S11	S3	SPECTRAL INDICES 11-6	ERR	6-3	ERR	OPT ID	NOTES	OTHER CATALOGUES
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
0723+67	07 23 04.9	67 54 53	CT21	28.4	1.31	1.58	.98	-.30	.11	-.38	.09	QSS	3	3C179,4C+67.14,DA233
0727+40	07 27 22.6	40 56 28	MP11	24.4	.522	.36	.52	.60	.14	-.00	.10	EF	2,5	OI+446
0730+50	07 30 04.2	50 28 41	MP11	27.1	.452	.48	.47	-.08	.11	.04	.11	*QSS	2	
0731+47	07 31 20.65	47 56 44.9	NRI1	26.8	.642	.54	.65	.29	.10	.02	.08	*QSS	2	
0733+59	07 33 11.9	59 47 47	MP11	28.9	.518	.51	.41	.03	.11	-.30	.12	GAL	2,5	OI+555
0740+38	07 40 56.75	38 00 31.3	RRE	26.1	.268	.58		-1.24	.10				4	3C186,4C+38.21,OI+368,B
0745+56	07 45 46.5	56 01 34	MP11	30.2	.680	1.42	.40	-1.19	.07	-.72	.25	*GAL	4	4C+56.16,OI+575,DA240
0746+48	07 46 39.96	48 22 30.4	NRI1	29.4	.796	.70	.79	.22	.09	-.01	.07	QSS	2	OI+478
0749+54	07 49 06.43	54 00 46.7	NRI1	30.5	.561	.67	.93	-.29	.09	.64	.07	QSS	2	OI+582
0749+42	07 49 35.3	42 39 25	MP11	28.8	.413	.57		-.51	.10					OI+483
0755+37	07 55 09.3	37 55 26	MP11	28.8	1.26	1.79	.86	-.58	.06	-.50	.12	E	4	4C+37.21,OI+392,B,NRAO276
0756+37	07 56 28.3	37 47 10	MP11	29.0	.426	.84		-1.09	.08					4C+37.21,OI+394,B,NRAO277
0757+50	07 57 51.9	50 18 02	MP11	31.5	.393	.74		-1.02	.09					OI+595
0759+64	07 59 20.2	64 11 42	MP11	32.1	.319	.38	.25	-.28	.14	-.33	.19	QSS	2	
0803+45	08 03 01.9	45 13 13	MP11	31.7	.292	.28		.09	.18					
0803+48	08 03 04.6	48 50 37	MP11	32.1	.323	.50		-.69	.11					4C+48.21,OJ+404.5
0804+49	08 04 58.38	49 59 23.3	NRI1	32.6	2.07	1.53	1.62	.49	.06	-.30	.05	*QSS	2	OJ+508
0805+41	08 05 33.60	41 01 34.1	NRI1	31.4	.766	.94	1.08	-.32	.07	.43	.06	QSS	2	
0806+42	08 06 37.9	42 36 58	RRE	31.9	.610	1.07	.27	-.91	.13	-1.07	.12	*GAL	3	3C194,4C+42.25,DA245
0809+40	08 09 30.8	40 28 09	MP11	32.1	.400	.64		-.76	.09					4C+40.20,OJ+411
0809+48	08 09 59.42	48 22 07.2	RRE	33.2	4.35	7.54	2.02	-.89	.05	-1.00	.05	QSS		3C196,4C+48.22,DA246
0812+36	08 12 10.67	36 44 28.4	NRI1	31.9	1.01	1.03	.98	-.02	.07	-.04	.06	QSS	2	OJ+320,B
0814+42	08 14 51.65	42 32 08.0	NRI1	33.4	1.68	2.21	2.47	-.45	.06	.48	.04	*QSS		OJ+425
0816+52	08 16 01.6	52 41 57	MP11	34.4	.776	1.22	.42	-.73	.07	-.82	.12	*GAL	2	4C+52.18,OJ+527
0818+47	08 18 01.1	47 12 11		34.5	.860	1.16	.30	-.49	.15	-1.36	.13	D	3	3C197.1,4C+47.28,OJ+429.9
0820+56	08 20 53.19	56 02 27.8	NRI1	35.1	.917	1.08	.88	-.26	.07	-.06	.07	QSS		OJ+535
0821+39	08 21 38.3	39 26 45	MP11	34.2	.993	1.10	1.18	-.17	.08	.21	.09	QSS	4,5,11	4C+39.23,OJ+336,B
0824+35	08 24 26.5	35 35 00	MP11	34.0	.572	.62	.50	-.12	.09	-.19	.10	*QSS	2	4C+35.20,OJ+341,B
0824+50	08 24 58.1	50 58 47	MP11	35.8	.229	.24		-.04	.21					OJ+452
0827+37	08 27 55.0	37 52 20	OPT	35.1	.930	1.37	.57	-.63	.19	-.64	.10	QSS	8	4C+37.24,OJ+346.5,B
0828+49	08 28 47.97	49 23 32.8	NRI1	35.4	1.02	1.17	.96	-.21	.07	-.09	.06	*QSS		OJ+448
0830+42	08 30 32.2	42 34 21	MP11	35.3	.410	.43		-.08	.12					OJ+451
0831+55	08 31 04.38	55 44 41.8	RRE	36.6	5.60	7.45	2.82	-.46	.05	-.89	.04	GAL		4C+55.16,OJ+552,DA251
0833+41	08 33 17.6	41 36 23	MP11	36.7	.306	.35		-.20	.15					OJ+456
0833+58	08 33 23.79	58 35 30.6	NRI1	36.6	1.11	.50	1.23	1.30	.11	.16	.06	QSS	2	

TABLE III (*continued*)

NAME	POSITION(1950.0) R.A.	DEC.		GAL LAT	FLUX DENSITIES S6	S11	S3	SPECTRAL INDICES 11-6	ERR	6-3	ERR	OPT ID	NOTES	OTHER CATALOGUES
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
0834+45	08 34 27.5	45 00 55	MP11	37.2	.578	.84	.29	-.61	.08	-.90	.31	*GAL	2,4	4C+45.17,OJ+457
0835+58	08 35 10.1	58 04 47	RRE	35.9	.670	1.11	.25	-.82	.14	-1.28	.13	*QSS	6	3C205,4C+58.16,OJ+558,DA254
0836+42	08 36 35.7	42 38 33	MP11	37.4	.345	.41		-.26	.13					4C+42.26,OJ+461
0840+42	08 40 11.8	42 26 19	MP11	38.0	.529	.83	.32	-.72	.08	-.65	.15	EF	2	OJ+467
0844+54	08 44 11.09	54 03 38.8	NRI1	38.6	.732	1.07	.43	-.61	.07	-.70	.21	GAL	4	4C+54.17,OJ+573
0847+37	08 47 12.6	37 58 21	MP11	38.9	.383	.48		-.35	.11					4C+37.25,OJ+378.6,B
0850+58	08 50 50.40	58 08 55.0	NRI1	38.9	1.41	.87	1.55	.78	.08	.14	.05	QSS	2	4C+58.17
0859+43	08 59 12.6	43 22 03	MP11	41.6	.315	.41		-.43	.13					
0859+68	08 59 23.01	68 09 16.1	NRI1	37.2	.539	.56	.52	-.06	.10	-.05	.10	QSS	2	
0859+47	08 59 39.92	47 02 58.0	NRI1	41.6	1.78	1.87	1.47	-.08	.06	-.25	.05	QSS	2	4C+47.29,OJ+499
0900+52	09 00 24.3	52 03 00	MP11	41.2	.384	.35		.17	.15					
0900+42	09 00 58.9	42 50 03	MP11	41.9	.761	.97	.72	-.39	.07	-.08	.08	*QSS	2	4C+42.28
0902+49	09 02 00.3	49 02 48	MP11	41.8	.529	.75	.30	-.55	.08	-.75	.16	*QSS	2	
0904+41	09 04 19.4	41 46 59	MP11	42.5	.469	.79	.30	-.84	.08	-.59	.30	EF	2,4	4C+41.19,OK+407,DA260
0905+38	09 05 41.1	38 00 30	CT21	42.6	.493	1.00	.13	-1.15	.11	-1.74	.20	EF	7	3C217,4C+38.26,OK+309.4,B,DA261
0906+43	09 06 17.25	43 05 59.4	RRE	42.8	1.78	2.39	1.41	-.48	.06	-.31	.05	QSS	10	3C216,4C+43.17
0912+48	09 12 02.0	48 56 13	MP11	43.5	.302	.47		-.72	.12					
0913+39	09 13 39.47	39 07 02.2	NRI1	44.2	.669	.85	.67	-.39	.08	-.01	.08	*QSS	2	4C+38.28,OK+323,B
0917+62	09 17 40.26	62 28 39.2	NRI1	41.0	.996	.87	1.36	.23	.08	.41	.05	QSS	2	OK+630
0917+44	09 17 41.88	44 54 40.2	NRI1	44.8	.863	.54	1.01	.66	.10	.31	.06	QSS	2	
0917+45	09 17 50.5	45 51 48	CAM	44.8	2.29	4.35	1.02	-1.04	.06	-1.06	.10	D		3C219,4C+45.19,OK+430,DA266
0919+53	09 19 18.9	53 15 15	MP11	43.8	.448	.81		-.96	.08					4C+53.18,OK+531
0920+39	09 20 06.1	39 02 34	MP11	45.4	.290	.32		-.16	.16					B
0921+45	09 21 28.0	45 24 49	MP11	45.4	.259	.38		-.62	.14					OK+434
0922+40	09 22 50.1	40 42 50	MP11	45.9	.355	.28		.41	.18					OK+438
0923+39	09 23 55.29	39 15 24.3	NRI	46.2	8.90	4.82	12.2	1.00	.05	.43	.04	QSS		4C+39.25,OK+340,B,DA267
0927+36	09 27 29.98	36 14 36.2	RRE	45.8	.590	.99	.33	-.84	.12	-.77	.09	QSS	3	3C220.2,4C+36.15,OK+345.8,B,DA26
0928+65	09 28 54.2	65 21 02	MP11	41.0	.313	.40	.24	-.38	.13	-.36	.20	EF	2	
0929+53	09 29 13.26	53 19 52.1	NRI1	45.3	.503	.51	.36	-.02	.11	-.43	.14	QSS	2	
0936+36	09 36 50.5	36 08 05	CAM	48.7	1.29	2.06	.72	-.76	.11	-.77	.19	D	3	3C223,4C+36.16,OK+361,B,DA269
0938+39	09 38 18.0	39 58 20	CAM	48.9	.870	1.23	.49	-.56	.13	-.74	.22	E	4,8	3C223.1,4C+39.28,OK+363.7,B
0941+52	09 41 30.07	52 16 23.0	NRI1	47.3	.481	.62	.50	-.40	.09	.03	.10			
0942+46	09 42 29.7	46 50 53	MP11	48.8	.364	.61		-.84	.12					OK+471
0945+66	09 45 13.7	66 28 55	MP11	41.9	1.22	1.62	.77	-.46	.06	-.60	.07	EF	2	4C+66.09
0945+40	09 45 50.04	40 53 43.6	NRI1	50.3	1.39	1.26	1.29	.16	.19	-.09	.05	QSS		4C+40.24,OK+476,DA273

TABLE III (*continued*)

NAME	POSITION(1950.0) R.A.	DEC.		GAL LAT	FLUX DENSITIES S6	S11	S3	SPECTRAL INDICES 11-6	ERR	6-3	ERR	OPT ID	NOTES	OTHER CATALOGUES
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
0951+69	09 51 43.0	69 54 59	CT21	40.6	3.94	5.59	2.35	-.57	.06	-.68	.05	I	3	3C231,4C+69.12,DA277
0951+48	09 51 51.0	48 52 31	MP11	49.9	.248	.20	.31	.35	.24	.28	.16			
0954+55	09 54 14.38	55 37 17.3	RRE	47.9	2.27	2.60	1.63	-.22	.06	-.43	.06	*QSS	10	4C+55.17,OK+591,DA278
0954+65	09 54 57.83	65 48 15.8	NRI1	43.1	1.46	1.22	1.40	.30	.07	-.05	.05	*QSS	2	
0955+47	09 55 08.54	47 39 28.7	NRI1	51.7	.739	.71	.75	.06	.09	.02	.07	*QSS		OK+492
1003+35	10 03 05.39	35 08 48.1	NRI	54.0	1.32	2.01	.96	-.68	.15	-.43	.10	D	3	3C236,4C+35.22,OL+305,B,DA281
1004+44	10 04 14.1	44 39 52	MP11	53.0	.420	.76		-.96	.08					4C+44.19,OL+407
1007+41	10 07 25.7	41 47 15	MP11	54.2	.706	1.04	.50	-.63	.07	-.46	.18	EF	2,4	4C+41.21,DA283
1010+35	10 10 54.80	35 00 44.5	RRE	55.6	.641	.46	.37	.54	.12	-.69	.11	QSS	10	OL+318,B
1014+39	10 14 16.2	39 16 26	MP11	55.9	.531	.83	.26	-.72	.08	-.92	.18	*GAL	5	4C+39.29,OL+323,B
1015+35	10 15 16.20	35 57 41.6	NRI1	55.4	.916	.63	1.04	.61	.09	.18	.06	QSS	2	OL+326,B
1016+57	10 16 44.9	57 20 07	MP11	49.9	.441	.64		-.60	.09					4C+57.17,OL+528
1018+34	10 18 23.6	34 52 24	MP11	57.1	.417	.46	.41	-.14	.12	-.03	.13	QSS	2	OL+331,B
1019+42	10 19 13.0	42 54 34	MP11	56.1	.386	.33	.42	.25	.15	.11	.12	EF	2	
1020+40	10 20 14.5	40 03 30	MP11	56.9	.866	1.06	1.18	-.33	.07	.39	.06	QSS	2	4C+40.25,B
1020+59	10 20 18.50	59 20 01.6	NRI1	49.2	.502	.84	.32	-.82	.08	-.61	.15	*QSS		4C+59.13,OL+534
1030+41	10 30 07.79	41 31 34.8	NRI1	58.4	1.13	1.02	1.48	.17	.07	.35	.05	*QSS	2	
1030+58	10 30 19.29	58 30 11.7	NRI1	50.7	1.12	1.95	.51	-.90	.08	-1.03	.07	*GAL	2,3	3C244.1,4C+58.21,OL+551,DA287
1030+39	10 30 27.54	39 51 19.8	NRI1	58.8	.690	.61	.50	.21	.09	-.40	.10	EF	2	B
1030+61	10 30 32.5	61 06 35	MP11	49.1	.563	.54	.44	.07	.10	-.31	.12	QSS	2	OL+651
1031+50	10 31 13.3	50 29 03	MP11	55.2	.401	.76		-1.04	.08					4C+50.30,OL+552
1031+56	10 31 55.92	56 44 18.6	NRI1	51.9	1.31	1.58	.76	-.30	.06	-.70	.14	EF	4	OL+553
1033+36	10 33 56.0	36 01 36	MP11	60.2	.170	.21		-.30	.24					
1038+52	10 38 43.4	52 49 19	MP11	55.0	.784	.65	.93	.32	.09	.22	.07	EF	2	OL+564
1039+50	10 39 04.8	50 29 17	MP11	55.3	.145	.37		-1.50	.15					4C+50.31,OL+565
1041+53	10 41 06.5	53 38 07	MP11	54.8	.386	.43		-.18	.12					OL+569
1043+55	10 43 15.8	55 14 45	MP11	54.1	.243	.49	.12	-1.14	.12	-.93	.40	EF	2	4C+55.21,OL+572
1044+47	10 44 35.74	47 41 22.8	NRI1	58.4	.457	.62	.35	-.48	.09	-.37	.15	*QSS	2	OL+474
1045+35	10 45 45.4	35 13 14	MP11	62.7	.384	.61		-.75	.10					4C+35.23,OL+376,B
1048+34	10 48 09.8	34 46 11	MP11	63.2	.290	.37		-.40	.14					OL+380,B
1050+54	10 50 56.0	54 17 50	MP11	55.5	.200	.27		-.49	.18					
1055+43	10 55 10.9	43 20 56	MP11	62.1	.295	.28		.09	.18					OL+491
1056+43	10 56 08.2	43 17 28	NRI	62.3	.949	1.55	.40	-.79	.12	-1.13	.13	*GAL	12	3C247,4C+43.20,OL+494,DA294
1058+39	10 58 41.7	39 20 46	MP11	64.2	.471	.35		.48	.15					B
1059+56	10 59 27.4	56 06 05	MP11	55.2	.370	.65		-.91	.09					4C+56.18,OL+598

TABLE III (*continued*)

NAME	POSITION(1950.0) R.A.	DEC.		GAL LAT	FLUX DENSITIES S6	S11	S3	SPECTRAL INDICES 11-6	ERR	6-3	ERR	OPT ID	NOTES	OTHER CATALOGUES
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
1101+38	11 01 40.1	38 28 51	MP11	65.0	.725	.77	.79	-.09	.08	.10	.07	GAL		OM+303,B
1106+38	11 06 44.5	38 00 48	MP11	66.1	.554	.70	.44	-.37	.09	-.31	.12	EF	2	4C+37.29,OM+311,B,DA296
1107+37	11 07 04.0	37 54 53	MP11	65.2	.640	1.26	.31	-1.09	.08	-.95	.16	*GAL	4	4C+37.29,OM+311,B,DA296
1107+60	11 07 13.0	60 44 57	MP11	52.5	.441	.46	.27	-.07	.12	-.66	.18	EF	2	
1107+48	11 07 45.3	48 34 09	MP11	61.2	.239	.39		-.79	.14					OM+413
1109+35	11 09 49.1	35 20 00	MP11	67.5	.175	.43	.42	-1.44	.13	1.08	.13	EF	2	OM+316.3
1109+43	11 09 50.5	43 42 11	MP11	64.2	.427	.84	.14	-1.10	.10	-1.44	.34	EF	2,4	4C+43.21,OM+417
1111+40	11 11 53.11	40 53 41.1	RRE	65.9	.790	1.45	.32	-.98	.13	-1.18	.12	*QSS	3	3C254,4C+40.28,DA298
1124+45	11 24 13.8	45 32 35	MP11	65.3	.350	.40		-.22	.13					
1124+57	11 24 49.9	57 06 59	MP11	56.8	.421	.44	.34	-.05	.12	-.27	.15	EF	2	
1125+58	11 25 42.0	58 49 49	MP11	55.4	.385	.58		-.67	.12				4	OM+543,DA302
1128+38	11 28 11.8	38 31 51	MP11	69.8	.771	.89	.93	-.22	.08	.23	.07	EF	2	OM+346.9,B
1128+45	11 28 55.5	45 31 35	MP11	65.9	.647	1.12	.36	-.88	.07	-.78	.14	EF		OM+448
1131+43	11 31 57.3	43 44 47	MP11	67.5	.532	.86	.29	-.78	.08	-.80	.17	EF	2,5	4C+43.22,OM+453.1,DA304
1133+43	11 33 14.8	43 15 35	MP11	68.0	.516	.89	.22	-.87	.08	-1.09	.21	EF	2	OM+455
1137+66	11 37 10.8	66 04 24	NRI	49.7	1.04	1.73	.57	-.82	.09	-.79	.07	QSS	3	3C263,4C+66.13,DA305
1138+59	11 38 05.75	59 29 03.4	NRI1	55.7	.767	1.23	.43	-.77	.07	-.77	.12	EF	2	4C+59.16,OM+564
1141+37	11 41 55.1	37 26 22	MP6	72.7	.610	1.19		-1.08	.08			EF	2,4	4C+37.32,OM+370,B,DA307
1144+54	11 44 04.57	54 13 22.7	NRI1	60.7	.878	.71	.73	.36	.09	-.22	.08	*QSS	2	
1144+40	11 44 20.3	40 15 17	MP11	71.5	.941	1.05	1.55	-.17	.07	.64	.05	*QSS	2	B
1146+59	11 46 09.5	59 41 36	MP11	56.0	.606	.44	.60	.52	.12	-.01	.09	GAL	2,5	
1146+53	11 46 19.2	53 11 07	MP6	61.7	.198									
1150+49	11 50 48.07	49 47 50.2	NRI1	65.0	1.11	1.56	1.48	-.55	.06	.36	.05	QSS		4C+49.22,OM+484
1151+38	11 51 18.0	38 28 24	MP11	73.6	.413	.58		-.55	.10					4C+38.32,OM+386,B,DA313
1151+45	11 51 44.6	45 40 17	MP11	68.5	.375	.58		-.71	.10					4C+45.23,OM+486
1152+55	11 52 52.0	55 10 16	MP11	60.4	.843	1.33	.52	-.73	.07	-.64	.20	GAL	4	4C+55.22,OM+588,DA314
1153+59	11 53 26.7	59 03 45	MP11	56.9	.575	.89	.37	-.71	.08	-.58	.14	*GAL		4C+59.17,OM+589
1155+48	11 55 52.5	48 42 06	MP11	66.3	.327	.35	.40	-.11	.15	.26	.13	EF	2	
1156+63	11 56 03.7	63 11 07	MP11	53.2	.253	.46	.13	-.95	.12	-.86	.36	EF	2	4C+63.15
1156+54	11 56 39.25	54 09 47.6	NRI1	61.6	.636	1.03	.35	-.77	.07	-.78	.14	EF	2	4C+54.25,OM+594
1203+64	12 03 54.08	64 30 18.7	NRI	52.2	1.16	2.00	.51	-.89	.06	-1.07	.10	*GAL	10	3C268.3,4C+64.14,DA316
1205+54	12 05 56.9	54 30 06	MP11	61.8	.445	.51		-.22	.11				13	
1206+43	12 06 41.98	43 55 59.9	RRE	71.4	.600	1.06	.26	-.92	.13	-1.09	.12	QSS	3	3C268.4,4C+43.23,ON+411,DA317
1208+59	12 08 59.6	59 39 33	MP6	57.0	.186									
1213+53	12 13 00.98	53 52 35.5	NRI1	62.7	.904	1.40	.37	-.71	.19	-1.15	.14	*QSS	4,5	4C+53.24,DA318

TABLE III (*continued*)

NAME	POSITION(1950.0) R.A.	DEC.		GAL LAT	FLUX DENSITIES S6	S11	S3	SPECTRAL INDICES 11-6	ERR	6-3	ERR	OPT ID	NOTES	OTHER CATALOGUES
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
1213+35	12 13 24.5	35 04 56	MP11	79.2	1.01	1.21	.79	-.29	.07	-.31	.07	QSS	2	4C+35.28,ON+323,8
1214+58	12 14 44.5	58 52 05	MP11	58.0	.372	.40	.50	-.10	.13	.39	.10	QSS	2	ON+524.5
1215+64	12 15 17.3	64 23 42	MP11	52.6	.291	.45	.18	-.71	.12	-.61	.26	QSS	2	4C+64.15
1216+48	12 16 38.55	48 46 35.2	NRI1	67.7	1.08	.96	1.05	.20	.07	-.03	.06	QSS	2	ON+428
1223+39	12 23 22.2	39 31 01	MP11	76.8	.405	.48		-.28	.11					ON+340,8
1225+36	12 25 30.79	36 51 47.1	RRE	79.3	.767	1.58	.26	-1.17	.19	-1.39	.18	EF	5	ON+343,8
1231+48	12 31 50.1	48 10 24	MP11	69.0	.311	.34		-.14	.15					
1232+36	12 32 38.6	36 38 03	MP11	80.1	.290	.25		.24	.20					
1233+41	12 33 10.2	41 53 42	MP11	75.1	.277	.41		-.64	.13					ON+455
1239+55	12 39 08.8	55 15 11	MP11	62.1	.205	.33		-.77	.16					ON+565
1239+37	12 39 45.6	37 36 35	MP11	79.6	.351	.37		-.08	.14					ON+367,8
1240+38	12 40 26.9	38 07 21	MP11	79.1	.579	.28	.66	1.18	.18	.19	.08	*QSS	2,5	8
1242+41	12 42 26.37	41 04 30.3	NRI1	75.3	.744	1.16	.53	-.72	.07	-.46	.10	*QSS	2	ON+470.5
1244+49	12 44 49.03	49 16 36.8	NRI1	68.1	.580	.80	.38	-.52	.08	-.57	.13	GAL	2	4C+49.25,ON+474
1250+56	12 50 15.19	56 50 37.0	RRE	60.6	1.05	1.53	.41	-.61	.10	-1.22	.08	QSS	3	3C277.1,4C+56.20,ON+584,DA332
1250+53	12 50 57.8	53 17 22	MP11	64.1	.498	.48	.49	.06	.11	-.03	.11		5	
1254+47	12 54 41.2	47 36 32	CT21	69.8	1.53	2.83	.77	-1.00	.08	-.90	.07	*GAL	3	3C280,4C+47.36,ON+490,DA335
1255+44	12 55 44.2	44 51 23	MP11	72.5	.308	.51		-.83	.14					4C+44.22,ON+493
1258+40	12 58 13.8	40 25 15	NRI	75.8	.360	.62	.14	-.88	.21	-1.23	.18		3	3C280.1,4C+40.32
1300+58	13 00 47.16	58 04 43.2	NRI1	59.3	.380	.42	.64	-.14	.13	.66	.09	*QSS	2	
1307+56	13 07 03.7	56 13 30	MP11	61.0	.452	.36	.42	.39	.14	-.09	.12	EF	2	
1311+55	13 11 33.3	55 14 17	MP11	61.9	.495	.79	.26	-.76	.08	-.84	.18		5	OP+519
1311+67	13 11 45.12	67 51 42.5	NRI1	49.4	.923	1.45	.50	-.73	.06	-.81	.10	EF	2	4C+67.22
1312+62	13 12 37.7	62 35 34	MP11	54.6	.201	.34	.17	-.83	.16	-.23	.28	EF	2	4C+62.21,OP+621
1312+53	13 12 37.9	53 22 11	MP11	63.7	.402	.39		.05	.13					OP+521
1314+45	13 14 00.5	45 20 20	MP11	71.4	.244	.41		-.84	.13					4C+45.27,OP+423
1315+34	13 15 18.0	34 41 07	MP11	80.8	.515	.54	.52	-.06	.10	.01	.10	EF	2	OP+326,8
1317+52	13 17 41.5	52 03 59	MP11	64.8	.716	.92	.45	-.40	.07	-.61	.11	QSS		4C+52.27,OP+530
1319+42	13 19 05.7	42 50 48	CAM	73.4	.760	1.23	.48	-.78	.14	-.61	.14	D	3	3C285,4C+42.37,OP+432,DA343
1321+41	13 21 58.6	41 03 37	MP11	74.8	.384	.47		-.33	.11					
1322+36	13 22 35.0	36 38 19	MP11	78.3	.469	.63		-.48	.09					4C+36.24,OP+337,8
1325+43	13 25 10.53	43 42 00.3	NRI1	72.1	.505	.60	.46	-.26	.10	-.13	.11	*QSS	2	
1327+50	13 27 01.8	50 24 55	MP11	65.9	.417	.36		.24	.14					
1333+45	13 33 15.69	45 57 56.4	NRI1	69.5	.757	.57	.66	.47	.10	-.16	.08	QSS	2	
1333+58	13 33 33.8	58 58 59	MP11	57.5	.826	.72	.74	.22	.08	-.14	.08	EF	2	4C+58.26,OP+556

TABLE III (*continued*)

NAME	POSITION(1950.0) R.A.	DEC.		GAL LAT	FLUX DENSITIES S6	S11	S3	SPECTRAL INDICES 11-6	ERR	6-3	ERR	OPT ID	NOTES	OTHER CATALOGUES
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
1335+47	13 35 35.6	47 57 02	MP11	67.5	.302	.46		-.68	.12					4C+47.37,OP+459
1335+55	13 35 55.24	55 16 16.9	NRI1	60.9	.631	.70	.57	-.17	.09	-.13	.09	QSS	2	OP+560
1336+39	13 36 38.5	39 06 22	RRE	74.7	.992	1.76	.37	-.93	.12	-1.29	.11	D	3	3C288,4C+39.39,OP+361,B,DA349
1337+63	13 37 46.6	63 44 06	MP11	52.8	.407	.46	.26	-.18	.12	-.56	.18	QSS	2	
1338+38	13 38 10.4	38 09 52	MP11	75.1	.338	.37		-.15	.14					OP+363
1339+53	13 39 39.1	53 59 52	MP11	61.8	.518	.76	.31	-.62	.08	-.68	.33	*GAL	2,4	4C+53.27,OP+566
1339+69	13 39 29.94	69 38 30.6	NRI1	47.1	.212	.30	.27	-.54	.17	.31	.18	QSS	2	
1340+60	13 40 29.8	60 36 48	NRI	55.7	.400	.81	.18	-1.14	.17	-1.05	.23		3	3C288.1,4C+60.18,OP+668
1342+662	13 42 18.2	66 17 33.5	NRI1	50.2	.537	.51	.48	.08	.14	-.14	.11	QSS	2,5	
1342+663	13 42 41.38	66 21 17.1	NRI1	50.2	.817	.61	.89	.47	.12	.13	.07	EF	2	
1343+43	13 43 26.5	43 05 16	MP11	70.8	.392	.64	.19	-.78	.09	-.93	.25	EF	2	4C+43.30,OP+472
1343+38	13 43 26.4	38 38 11	MP11	74.0	.416	.55		-.45	.10					4C+38.37,OP+372.2,B
1343+50	13 43 27.52	50 01 32.5	RRE	65.1	.600	1.17	.26	-1.08	.12	-1.10	.12	EF	3	3C289,4C+50.37,OP+572
1343+45	13 43 28.5	45 07 56	MP11	69.2	.308	.28		.15	.18					
1347+53	13 47 42.54	53 56 08.7	NRI1	61.4	.962	1.00	.91	-.05	.07	-.07	.07	*QSS	2	4C+53.28,OP+580
1349+64	13 49 14.3	64 44 33	CT21	51.4	.720	1.06	.75	-.63	.19	.03	.19	EF	2,8	3C292,4C+64.19
1355+44	13 55 38.28	44 08 34.0	NRI1	68.6	.577	.71	.34	-.34	.09	-.69	.14	EF	2	OP+493
1356+47	13 56 43.01	47 52 31.0	NRI1	65.6	.517	.60	.35	-.24	.10	-.50	.14	*GAL	2	OP+494
1358+62	13 58 58.30	62 25 08.4	NRI1	53.1	1.77	2.66	.99	-.66	.06	-.77	.06	EF	2	4C+62.22
1401+38	14 01 05.0	38 42 24	MP11	71.2	.219	.37		-.85	.14					4C+38.38,B
1402+66	14 02 48.30	66 05 57.6	NRI1	49.6	.697	1.10	.50	-.73	.07	-.44	.10	EF	2	4C+66.14
1406+56	14 06 32.9	56 27 41	MP11	57.8	.479	.44	.43	.14	.12	-.14	.12	QSS	2	
1408+37	14 08 36.1	37 01 32	MP11	70.7	.440	.70		-.74	.09					4C+37.40,OQ+314,B
1409+37	14 09 08.5	37 19 18	MP11	70.4	.204	.22		-.13	.22					
1409+52	14 09 33.50	52 26 13.0	RRE	60.8	6.48	11.8	2.76	-.97	.05	-1.12	.04	E		3C295,4C+52.30,OQ+514,DA360
1413+34	14 13 56.29	34 58 29.5	NRI	70.4	1.17	1.70	.74	-.61	.09	-.60	.09	EF	10	OQ+323,B
1415+46	14 15 13.59	46 20 50.4	NRI1	64.5	.675	.60	.56	.19	.10	-.24	.09	EF	2	4C+46.29,OQ+425
1418+54	14 18 06.18	54 36 57.9	NRI1	58.3	1.09	.94	1.43	.24	.07	.35	.05	*QSS	2	OQ+530
1419+41	14 19 06.38	41 58 30.9	CAM	66.6	.900	1.61	.39	-.94	.11	-1.09	.10	DB	12	3C299,4C+41.27,OQ+432,DA365
1427+54	14 27 43.7	54 19 28	MP11	57.6	.535	.61	.52	-.21	.09	-.34	.10	*QSS	2	OQ+546
1432+42	14 32 32.1	42 49 30	MP11	64.0	.340	.55		-.78	.10					
1433+55	14 33 54.1	55 20 59	MP11	56.2	.171	.27		-.74	.19					4C+55.29,OQ+557
1435+63	14 35 37.23	63 49 35.8	NRI1	49.7	1.24	1.41	1.01	-.21	.06	-.27	.06	QSS	2,14	
1436+44	14 36 35.7	44 31 18	MP11	62.5	.328	.26		.41	.19					
1436+37	14 36 52.0	37 23 34	MP11	65.2	.277	.27		.04	.18					OQ+361.3,B

TABLE III (*continued*)

NAME	POSITION(1950.0) R.A.	DEC.		GAL LAT	FLUX DENSITIES S6	S11	S3	SPECTRAL INDICES 11-6	ERR	6-3	ERR	OPT ID	NOTES	OTHER CATALOGUES
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
1437+62	14 37 32.06	62 24 46.9	NRI1	50.7	.862	1.39	.44	-.77	.06	-.87	.11	QSS	2	OQ+663
1438+33	14 38 22.57	38 33 04.1	NRI1	64.6	.770	.88	.56	-.22	.08	-.41	.09	EF	2	OQ+363,B
1441+40	14 41 03.0	40 57 11	MP11	63.3	.325	.56		-.87	.57					OQ+467
1441+52	14 41 23.6	52 14 19	CT21	57.5	.940	1.55	.81	-.81	.13	-.22	.11	*QSS	8	3C303,4C+52.33,OQ+568,DA369
1442+50	14 42 02.7	50 47 10	MP11	58.3	.397	.68		-.87	.09					4C+50.38,OQ+569
1448+63	14 48 17.45	63 28 33.6	CAM	49.1	.920	1.60	.47	-.90	.09	-.88	.12	GAL	12	3C305,4C+63.21,DA370
1451+35	14 51 16.5	35 17 39	MP11	62.8	.189	.18		.13	.27					
1452+50	14 52 23.7	50 15 41	30C	57.3	.540								6	3C308,4C+50.40,OQ+587
1459+48	14 59 07.27	48 03 04.1	NRI1	57.4	.438	.45	.50	-.05	.12	.16	.10	*QSS	2	
1500+57	15 00 16.0	57 09 34	MP11	52.3	.432	.73		-.84	.09					4C+57.25,OR+501
1504+37	15 04 12.8	37 42 19	MP11	59.9	1.10	.97	1.56	.21	.07	.45	.05	EF	2	OR+306,B
1506+59	15 06 35.6	59 08 58	MP11	50.4	.345	.43		-.36	.12					
1507+47	15 07 39.6	47 38 18	MP11	56.3	.412	.73		-.92	.09					4C+47.40,OR+412.8,NRAO468
1512+37	15 12 47.1	37 01 51	MP11	58.3	.406	.54	.29	-.45	.11	-.44	.22		4	4C+37.43,OR+321,B
1522+54	15 22 44.9	54 38 52	CAM	51.1	.650	1.25	.30	-1.06	.11	-1.02	.11	*GAL	3	3C319,4C+54.34,OR+538,DA383
1526+67	15 26 12.15	67 01 16.7	NRI1	43.8	.462	.23	.37	1.17	.21	-.27	.14	*QSS	2	
1526+37	15 26 34.7	37 48 26	MP11	55.5	.356	.61		-.87	.10					4C+37.44,OR+344,B
1529+35	15 29 29.3	35 43 47	MP11	55.1	.502	.91	.22	-.96	.08	-1.06	.21	*GAL		3C320,4C+35.36,OR+349,B,DA384
1533+55	15 33 46.3	55 46 50	CAM	49.1	.460	.85	.19	-.99	.16	-1.16	.14		3	3C322,4C+55.31,OR+556,DA386
1534+50	15 34 22.4	50 07 28	MP11	51.3	.275	.36		-.44	.15					
1543+51	15 43 38.8	51 44 21	MP11	49.4	.436	.52		-.27	.11					OR+573
1544+39	15 44 05.9	39 51 05	MP11	51.9	.321	.39		-.32	.13					
1545+49	15 45 53.15	49 46 16.7	NRI1	49.7	.539	.69	.41	-.39	.09	-.35	.12	EF	2	4C+49.26,OR+476
1547+50	15 47 52.6	50 47 13	MP11	49.1	.738	.69	.65	.12	.09	-.16	.08	QSS	2	OR+580
1549+62	15 49 14.1	62 50 22	CT21	44.1	.830	1.84	.42	-1.29	.10	-.90	.09	EF	3	3C325,4C+62.25,DA390
1554+43	15 54 57.6	43 06 08	MP11	49.5	.472	.89		-1.03	.09				4	4C+43.35,OR+492
1557+70	15 57 37.1	70 49 45	MP6	39.3	1.02	1.76		-.89	.06			*GAL	4,15	4C+70.19
1602+57	16 02 55.1	57 39 00	MP11	44.7	.476	.41		.24	.13					
1609+66	16 09 16.2	66 04 31	CAM	40.7	2.35	3.76	1.02	-.76	.07	-1.09	.06	EF	3	3C330,4C+66.17,DA404
1615+36	16 15 05.6	36 29 18	MP11	45.9	.405	.27		.69	.18					4C+36.27,OS+325.3,B
1615+35	16 15 43.3	35 08 58	MP11	45.6	.597	1.07		-.94	.08			EF	2,4	4C+35.40,OS+326.1,B,DA408
1619+49	16 19 07.2	49 08 49	MP11	44.5	.408	.42		-.05	.13					
1624+41	16 24 18.21	41 41 23.3	RRE	44.2	1.31	1.58	1.14	-.30	.06	-.19	.05	EF	2,10	4C+41.32,OS+440,DA411
1626+39	16 26 55.3	39 39 31	CAM	43.7	.490	1.24	.18	-1.51	.13	-1.32	.16	GAL	3	3C338,4C+39.45,OS+345,B,DA413
1627+44	16 27 19.7	44 25 37	CT21	43.6	.910	1.57	.50	-.88	.13	-.79	.07	*GAL	3	3C337,4C+44.28,OS+446,DA414

TABLE III (*continued*)

NAME	POSITION(1950.0) R.A.	DEC.		GAL LAT	FLUX DENSITIES S6	S11	S3	SPECTRAL INDICES 11-6	ERR	6-3	ERR	OPT ID	NOTES	OTHER CATALOGUES
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
1629+43	16 29 38.7	43 55 04	MP11	43.2	.339	.52		-.69	.11					4C+43.39,OS+449,NRAO508
1629+68	16 29 50.85	68 03 38.7	NRI1	38.0	.413	.58	.27	-.54	.10	-.54	.18	QSS	2	4C+68.18
1629+49	16 29 55.5	49 34 00	MP11	42.7	.440	.32		.52	.16					OS+450
1632+39	16 32 19.3	39 06 10	MP11	42.6	.393	.55	.27	-.55	.10	-.49	.18			4C+39.46,OS+353.8,B
1633+38	16 33 30.64	38 14 10.0	NRI1	42.3	4.08	2.50	6.03	.80	.06	.52	.04	QSS		4C+38.41,OS+356,B
1634+62	16 34 01.05	62 51 41.4	NRI	39.4	1.50	2.68	.70	-.94	.06	-1.00	.06	QSS	7	3C343,4C+62.26,DA416
1636+47	16 36 19.3	47 23 33	MP11	41.9	.639	.70	.68	-.15	.09	.08	.08	*QSS	2	4C+47.44,OS+460
1637+57	16 37 17.43	57 26 15.8	NRI1	40.4	1.44	.98	1.73	.63	.07	.25	.05	QSS	2	OS+562
1637+62	16 37 55.34	62 40 34.0	NRI	39.0	1.20	2.23	.50	-1.01	.08	-1.14	.07	*GAL	3	3C343.1,4C+62.27,DA419
1638+39	16 38 48.1	39 52 34	MP11	41.4	1.16	1.08	1.72	.12	.07	.51	.05	QSS	10	OS+264.6,NRAO512
1641+39	16 41 17.61	39 54 11.3	NRI	40.9	10.9	8.40	11.1	.42	.05	.03	.04	QSS		3C345,4C+39.48,OS+368,B,DA420
1641+37	16 41 20.3	37 35 08	MP11	40.7	.433	.70		-.78	.09					3C344,4C+37.49,OS+368.8,B,DA421
1642+69	16 42 18.03	69 02 13.7	NRI1	36.6	1.43	1.42	1.90	.02	.06	.37	.05	*QSS	2	4C+69.21
1645+41	16 45 17.8	41 04 38	MP11	40.3	.366	.22		.80	.22					
1652+39	16 52 11.75	39 50 24.6	RRE	38.9	1.42	1.44	1.19	-.01	.06	-.23	.06	N	10	4C+39.49,OS+387,B,DA426
1656+34	16 56 12.29	34 47 59.4	NRI1	37.4	.821	.48	1.03	.89	.11	.31	.06	QSS	2	OS+392,B
1656+48	16 56 25.1	48 13 03	MP11	38.5	.776	.89	.81	-.22	.07	.05	.07	EF	2	4C+48.41
1656+57	16 56 26.3	57 10 23	MP11	37.9	.621	.69	.55	-.16	.09	-.16	.09	QSS	2	4C+57.28,OS+594
1656+47	16 56 39.60	47 42 19.6	NRI1	38.4	.923	.73	.86	.39	.08	-.07	.07	QSS	2,16	
1658+47	16 58 05.06	47 07 08.5	NRI1	38.2	1.14	1.88	.58	-.81	.09	-.89	.07	*GAL	3	3C349,4C+47.45,OS+497,DA428
1703+38	17 03 22.0	38 44 28	MP11	35.6	.414	.74	.26	-.94	.09	-.62	.25		4	3C350,4C+38.43,OT+306,B
1704+60	17 04 05.0	60 48 44	CAM	35.4	1.21	2.03	.59	-.84	.09	-.94	.09	QSS	3	3C351,4C+60.24,OT+607,DA430
1709+46	17 09 17.94	46 05 06.3	RRE	35.2	.470	.95	.23	-1.14	.15	-.94	.14		3	3C352,4C+46.34,OT+416,DA432
1716+68	17 16 27.84	68 39 48.7	NRI1	33.7	.585	.49	1.19	.30	.11	.91	.06	*QSS	2	
1718+38	17 18 28.9	38 28 41	MP11	33.6	.206	.22		-.09	.22					B
1719+35	17 19 22.6	35 45 09	MP11	32.9	.859	.64	.84	.48	.09	-.02	.11	QSS	2,4	OT+332,B
1721+34	17 21 32.0	34 20 30	MP11	32.2	.934	1.22	.54	-.43	.07	-.72	.10	QSS	4	4C+34.47,OT+336,B
1722+40	17 22 27.17	40 07 15.9	NRI1	33.2	.656	.68	.66	-.05	.09	.01	.08	*QSS	2	B
1723+51	17 23 07.1	51 30 16	CAM	34.2	.333	.65	.13	-1.08	.55	-1.23	.44		10	3C356,4C+51.36,OT+538
1726+45	17 26 01.18	45 33 04.6	NRI1	33.3	.625	.72	1.21	-.23	.09	.84	.06	QSS	2	
1729+49	17 29 27.4	49 08 35	MP11	33.1	.302	.46		-.68	.12					4C+49.29,OT+449.2
1732+38	17 32 40.3	38 59 47	MP11	31.0	1.15	.67	.89	.88	.09	-.32	.07	*GAL	2	OT+355,B
1734+36	17 34 02.5	36 18 31	MP11	31.2	.283	.32		-.20	.16					OT+357,B
1734+50	17 34 36.62	50 51 00.2	NRI1	32.4	.803	.60	.72	.49	.10	-.13	.08	EF	2	
1734+44	17 34 39.2	44 31 16	MP6	31.6	.141									

TABLE III (*continued*)

NAME	POSITION(1950.0) R.A.	DEC.		GAL LAT	FLUX DENSITIES S6	S11	S3	SPECTRAL INDICES 11-6	ERR	6-3	ERR	OPT ID	NOTES	OTHER CATALOGUES
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
1738+49	17 38 12.71	49 56 35.4	NRI1	31.7	.607	.53	.54	.23	.10	-.15	.10	*QSS	2	OT+463
1738+47	17 38 36.8	47 39 24	MP11	31.4	.904	.84	.85	.12	.08	-.07	.07	QSS	2	OT+465
1739+52	17 39 28.96	52 13 11.1	NRI1	31.7	1.99	1.93	1.37	.05	.06	-.48	.05	QSS	2	4C+51.37,OT+566
1742+61	17 42 22.1	61 47 04	MP11	31.7	.465	.75	.23	-.77	.08	-.92	.21	QSS	2	4C+61.34,OT+671
1742+40	17 42 47.4	40 16 02	MP11	29.4	.467	.62	.31	-.46	.09	-.55	.16	EF	2	OT+471.3
1743+55	17 44 00.40	55 43 24.8	NRI1	31.3	.521	.62	.45	-.28	.12	-.20	.20	D	2,4	
1743+39	17 43 58.6	39 52 27	MP11	29.1	.276	.40		-.58	.14					OT+371.8
1745+62	17 45 48.1	62 27 52	MP11	31.3	.578	.57	.46	.02	.10	-.30	.11	*GAL	2	4C+62.29,OT+676
1747+59	17 47 29.2	59 44 21	MP6	31.1	.455		.25			-.81	.20	*GAL	2	3C363,4C+59.28,OT+579,DA440
1749+70	17 49 03.44	70 06 39.7	NRI1	30.7	1.09	1.89	1.39	-.88	.06	.28	.05	QSS	2	
1751+44	17 51 53.9	44 10 23	MP11	28.5	1.04	.59	1.22	.93	.10	.22	.06	QSS	2	OT+486.4
1752+35	17 52 28.2	35 41 16	MP11	25.4	.170	.19		-.14	.26					OT+387
1752+45	17 52 44.1	45 06 44	MP11	28.6	.210	.40		-1.05	.14					4C+45.37,OT+488
1755+57	17 55 15.9	57 49 05	MP11	30.0	.494	.72		-.60	.09					OT+592
1758+65	17 58 34.20	66 38 04.3	NRI1	30.0	.885	.86	.83	.06	.08	-.08	.07	PLN	2	
1758+38	17 58 44.5	38 48 36	MP11	26.0	.916	.42	1.62	1.28	.13	.76	.05	QSS	2	OT+398,B
1759+48	17 59 32.8	48 32 34	MP6	28.1	.366		.24			-.54	.20	*GAL		3C367,4C+48.43,OT+499
1800+44	18 00 03.20	44 04 17.6	NRI1	27.1	1.02	.63	1.12	.79	.09	.14	.06	QSS	2	OU+401
1802+48	18 02 43.5	48 52 13	MP11	27.6	.163	.27		-.81	.19					4C+48.44,OU+405
1806+45	18 06 56.7	45 41 49	MP11	25.3	.695	.26	.70	1.63	.19	.05	.08	QSS	2	
1807+69	18 07 18.55	69 48 57.0	NRI	29.2	2.33	2.21	1.81	.09	.06	-.32	.05	N	10	3C371
1811+43	18 11 43.25	43 03 20.6	NRI1	24.8	.571	.72	.48	-.38	.09	-.24	.11	QSS	2	4C+43.48,OU+420,NRAO550
1812+41	18 12 47.2	41 12 05	MP11	24.1	.450	.49		-.12	.11					4C+41.37,OU+421,NRAO551
1818+35	18 18 55.7	35 39 13	MP11	21.3	.518	.71	.37	-.51	.09	-.44	.14	EF	2	
1819+35	18 19 33.5	35 13 28	MP11	21.0	.325	.55		-.85	.10					4C+35.43,OU+331,B,NRAO555
1819+39	18 19 42.39	39 41 13.8	RRE	22.4	.971	1.78	.38	-.98	.06	-1.23	.13	GAL		4C+39.56,OU+332.9,B,DA449
1820+39	18 20 21.7	39 44 39	MP11	22.3	.371	.36		.05	.14					B
1823+56	18 23 14.92	56 49 18.0	NRI1	26.1	1.67	1.51	2.28	.17	.06	.40	.04	*QSS	2	4C+56.27,OU+539
1825+34	18 25 11.9	34 29 26	MP6	19.7	.370									OU+343,B
1828+48	18 28 13.47	48 42 41.0	NRI	23.5	6.19	9.39	4.78	-.68	.05	-.35	.04	QSS	10	3C380,4C+48.46,OU+447,DA452
1828+39	18 28 18.1	39 55 30	MP11	20.9	.427	.39		.17	.13					
1830+62	18 30 57.9	62 28 14	MP11	25.1	.382	.60	.19	-.73	.10	-.92	.25	QSS	2	4C+62.30,OU+651
1832+47	18 32 24.3	47 24 48	CAM	22.5	1.29	2.30	.79	-.94	.08	-.65	.07	N	3	3C381,4C+47.49,OU+454,DA455
1833+65	18 33 33.7	65 19 11	MP6	26.3	.799	1.23	.38	-.70	.09	-.97	.13	*GAL	9	3C383,4C+65.23,DA458
1834+61	18 34 46.2	61 17 07	MP11	25.5	.412	.56	.42	-.50	.10	0.00	.12	QSS	2	OU+659

TABLE III (*continued*)

NAME	POSITION(1950.0) R.A.	DEC.		GAL LAT	FLUX DENSITIES S5	S11	S3	SPECTRAL INDICES 11-6	ERR	6-3	ERR	OPT ID	NOTES	OTHER CATALOGUES
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
1842+45	18 42 35.5	45 30 22	CT21	20.2	1.77	3.11	.95	-.91	.06	-.82	.08	GAL	3	3C388,4C+45.39,OU+471,DA462
1842+68	18 42 43.6	68 06 16	MP11	25.9	.810	.87	1.50	-.11	.08	.79	.05	QSS	2	
1843+40	18 43 32.3	40 04 41	MP11	18.2	.565	.93	.47	-.53	.07	-.45	.11	*GAL	2,5	
1843+35	18 43 48.3	35 38 04	MP11	15.5	.812	.95	.49	-.25	.07	-.66	.11	EF	2,5	OU+373
1849+67	18 49 16.47	67 02 07.6	NRI1	25.0	.590	.95	.60	-.76	.07	.01	.09	*QSS	2	
1850+40	18 50 52.0	40 15 24	MP5	17.0	.530		.44			-.23	.11	QSS	2,5	B
1851+48	18 51 08.9	48 52 06	MP11	19.9	.565	.57	.26	-.01	.10	-1.00	.19	*QSS	2,5	
1853+37	18 53 44.2	37 39 01	MP6	15.5	.401									
1855+52	18 55 35.9	52 54 04	MP11	20.6	.291	.49		-.84	.11					3C393,4C+52.44,OU+593
1917+55	19 17 07.9	55 15 19	MP5	18.4	.260									
1917+39	19 17 28.3	39 10 56.8	NRI1	11.9	.625	.97	.42	-.72	.08	-.52	.24	GAL	2,4,5	4C+39.58,OV+329,B
1922+47	19 22 02.6	47 48 21	MP6	14.8	.296									OV+437
1926+61	19 26 49.13	61 11 22.9	NRI1	19.4	.721		.80			.14	.07	*QSS	2,5	
1926+44	19 26 48.5	44 05 51	MP5	12.4	.261									
1930+44	19 30 38.2	44 47 56	MP5	12.1	.467									4C+44.34,OV+451
1939+60	19 39 38.6	60 34 30	RRE	17.8	1.52	2.76	.67	-.96	.08	-1.08	.08	*GAL	7	3C401,4C+60.29,OV+666,DA489
1940+50	19 40 21.4	50 28 49	CAM	13.3	.333	1.72		-.99	.11			GAL	4,9	3C402,4C+50.49,DA490
1943+54	19 43 22.7	54 40 48	MP11	14.8	.850	1.20	.50	-.55	.07	-.70	.10	*GAL	5	OV+573
1954+51	19 54 22.3	51 23 50	MP11	11.8	1.43	1.57	1.33	-.15	.06	-.10	.05	QSS	5	OV+591
1957+51	19 57 09.1	51 42 29	MP11	11.5	.365	.61		-.83	.10				4	4C+51.40,OV+594
2007+65	20 07 01.9	65 58 35	MP5	17.4	.457	.49		-.12	.12					
2007+52	20 07 35.2	52 04 46	MP11	10.3	.294	.54		-.98	.20					3C408,4C+52.47,OW+513
2015+65	20 15 24.66	65 45 44	NRI1	16.6	.513	.94	.37	-.70	.08	-.66	.14	EF	2,5	
2021+61	20 21 13.6	61 27 18	MP11	13.8	2.31	2.17	1.95	.10	.06	-.21	.05	*QSS	5	OW+637
2034+58	20 34 13.8	58 10 56	MP6	10.6	.302	.39		-.42	.14					OW+558
2135+34	21 35 37.5	34 42 08	MP11	-12.9	.395	.45		-.23	.11				1	OX+358,B
2153+37	21 53 45.6	37 46 13	CT21	-13.0	1.54	3.22	.64	-1.19	.08	-1.15	.07	*GAL	3	3C438,4C+37.63,OX+390,B,DA570
2200+42	22 00 39.37	42 02 08.8	NRI	-10.4	4.75	5.15	5.82	-.13	.05	.26	.04	GAL		OY+401
2207+37	22 07 11.57	37 27 31.8	NRI1	-14.9	.791	1.23	.48	-.72	.07	-.66	.11	QSS	2,5	4C+37.65,OY+311,B
2214+35	22 14 07.0	35 03 15	RRE	-17.6	.924	.74	.55	.18	.09	-.49	.09	QSS	5	OY+324,B
2218+39	22 18 21.0	39 33 36	MP11	-14.4	.585	.99	.41	-.60	.07	-.69	.12	QSS	2,5	4C+39.66,OY+331,B,NRAO684
2226+39	22 26 33.7	39 42 19	MP11	-15.1	.306	.49		-.76	.14				1	3C447,4C+39.68,OY+344,B
2229+39	22 29 06.6	39 05 34	CAM	-15.9	1.39	2.47		-.93	.10			D	8	3C449,4C+39.69,OY+348,B,DA581
2231+35	22 31 22.2	35 45 40	MP11	-19.0	.390	.69		-.92	.09				1	4C+35.53,OY+352,B
2231+42	22 31 22.1	42 30 02	MP11	-13.2	.137	.14		.01	.34				1	

TABLE III (*continued*)

NAME	POSITION(1950.0) R.A.	DEC.		GAL LAT	FLUX DENSITIES S6	S11	S3	SPECTRAL 11-6	ERR	INDICES 6-3	ERR	OPT ID	NOTES	OTHER CATALOGUES
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
2237+43	22 37 55.6	43 17 45	MP11	-13.2	.303	.47		-.71	.11				1	4C+43.55,OY+463,NRAO693
2238+41	22 38 53.3	41 04 33	MP6	-15.2	.316	.35		-.18	.15					OY+465
2241+40	22 41 57.7	40 41 29	MP11	-15.8	.367	.35		.09	.14				1	OY+470
2243+39	22 43 31.8	39 25 31	CAM	-17.1	3.26	5.87		-.95	.07			E	8	3C452,4C+39.71,OY+372,B,DA584
2244+36	22 44 12.9	36 40 43	MP11	-19.5	.695	1.13	.34	-.79	.07	-.94	.14	E	5	4C+36.47,OY+373,B
2253+41	22 53 19.9	41 46 51	MP11	-15.8	.990	1.17	1.00	-.27	.06	.00	.06	QSS	1,2,5	OY+489
2255+41	22 55 04.65	41 38 13.6	RRE	-16.1	.993	1.42	.62	-.58	.06	-.62	.09	EF	1,2,10	4C+41.45,OY+492,DA589
2302+40	23 02 34.6	40 12 44	MP11	-18.0	.398	.70		-.92	.08				1	4C+40.48,OZ+404
2304+37	23 04 39.3	37 46 29	RRE	-20.4	.560	.88		-.73	.08			EF	2	OZ+308,B
2309+45	23 09 29.3	45 27 34	MP11	-13.7	.273	.22		.35	.22				1	OZ+416
2311+46	23 11 28.87	46 55 54.4	NRI1	-12.5	.726	1.11	.43	-.69	.07	-.69	.12	*QSS	5	4C+46.47,OZ+419,DA596
2315+39	23 15 24.9	39 36 07	MP6	-19.5	.383	.54		-.56	.11					4C+39.73,OZ+326,B
2320+36	23 20 40.2	36 12 29	MP11	-23.1	.253	.43		-.84	.13					4C+36.50,OZ+334,B
2321+42	23 21 30.1	42 19 15	MP11	-17.4	.301	.51		-.86	.11				1	OZ+436
2323+43	23 23 18.18	43 30 28.3	NRI1	-16.4	1.01	1.35	.58	-.47	.06	-.73	.09	*GAL	4,5	OZ+438
2323+42	23 23 29.22	42 15 35.9	NRI1	-17.6	.661	.57	.63	.24	.10	-.05	.09	PLN	2,5	OZ+439
2324+40	23 24 30.7	40 31 38	CT21	-19.3	1.12	1.51	.57	-.48	.17	-.88	.12	EF	2,3	3C462,4C+40.50,OZ+440.9,DA603
2330+40	23 30 26.1	40 14 02	MP6	-19.9	.335	.50		-.64	.12					OZ+451
2330+38	23 30 35.6	38 44 38	RRE	-21.4	.438	.59		-.47	.10					OZ+350,B
2346+50	23 46 06.7	50 26 54	MP11	-10.9	.356	.59		-.82	.09				1	3C468,4C+50.29,OZ+577
2346+38	23 46 49.80	38 32 36.8	NRI1	-22.5	.597	.39	.66	.69	.13	.15	.08	QSS		
2348+45	23 48 56.8	45 01 49	MP11	-16.3	.225	.39		-.90	.13				1	4C+45.50,OZ+481
2351+45	23 51 50.1	45 36 22	MP11	-15.8	1.41	1.48	1.04	-.07	.06	-.39	.06	*GAL	2,10	4C+45.51,OZ+486
2352+49	23 52 37.3	49 33 28	MP11	-12.0	1.77	2.18	1.12	-.33	.06	-.60	.05	*GAL	1,10	OZ+488,DA611
2354+47	23 54 56.7	47 09 33	MP6	-14.4	.646	1.06	.31	-.81	.07	-.98	.33	*GAL	4,5	4C+47.63,OZ+492,DA613
2356+43	23 56 02.29	43 47 56.8	RRE	-17.8	.549	1.04	.22	-1.04	.13	-1.20	.14	EF	3	3C470,4C+43.59,DA614
2356+39	23 56 27.0	39 05 46	MP11	-22.4	.249	.32		-.38	.16					B
2357+38	23 56 59.79	38 34 00.1	NRI1	-22.9	.636	.54	.71	.27	.10	.14	.08	QSS		OZ+395,B
2358+40	23 58 19.38	40 37 19.6	NRI1	-21.0	.586	.84	.38	-.58	.07	-.58	.13	EF	2	4C+40.52,OZ+496

Notes to Table III

(1) 2.7 GHz flux density measured in 1976, January.
(2) Optical classification on basis of quoted position (Kühr 1977; in preparation)
(3) Source not reobserved. Flux densities at 5,2.7 and 10.7 GHz taken from Pauliny-Toth and Kellermann (1968), Kellermann *et al.* (1968a) and Pauliny-Toth and Kellermann (1973), respectively.
(4) Present measurements indicate source is extended. Integrated flux densities are quoted.
(5) 10.7 GHz flux density measured in 1976 February.
(6) Known source with flux density greater than 0.5 Jy, but not detected by finding survey. Not included in source counts.
(7) Source not reobserved at 2.7 and 10.7 GHz. References as in 3.
(8) Source not reobserved at 5 and 2.7 GHz. References as in 3.
(9) Source not reobserved at 2.7 GHz. Reference as in 3.
(10) Source not reobserved at 10.7 GHz. Reference as in 3.
(11) A weaker source, with a 2.7-GHz flux density of 0.75 Jy, lies 5.2 arcmin east and 3.5 arcmin north. The apparent extension of 0821 + 39 may be due to confusion with this source.
(12) Source not reobserved at 5 and 10.7 GHz. References as in 3.
(13) A weaker source, with a flux density of 0.25 Jy at 2.7 GHz, lies 10.5 arcmin west and 5 arcmin south.
(14) Extension of source, or confusing source with 0.3 Jy at 2.7 GHz, 6.5 arcmin west and 4 arcmin north.
(15) Double source, components of about equal strength, separated by 6.7 arcmin in PA 160°.

TABLE IV. Counts of strong sources at 5 GHz.

Flux density (Jy)	S4	S1	S2 S3	Parkes	Parkes fast	Combined counts n	Area	n/sr	n/n_0
		Counts from individual surveys							
$.40 \leq S < .50$	55(7)					62	1.186	52.3 ± 7.2	0.79 ± .11
$.50 \leq S < .54$	32(5)					37	1.785	20.7 ± 3.7	1.12 ± .20
$.54 \leq S < .60$	27(2)					29	1.785	16.2 ± 3.1	0.73 ± .14
$.60 \leq S < .68$	31(2)		44(2)	54(1)		134	6.420	20.9 ± 1.8	0.95 ± .08
$.68 \leq S < .80$	41		56	53		150	6.420	23.4 ± 1.9	1.01 ± .08
$.80 \leq S < .96$	39	9	48	50		146	6.694	21.8 ± 1.8	1.09 ± .09
$.96 \leq S < 1.3$	47	7	46	53	40(4)	197	8.914	22.1 ± 1.6	0.95 ± .07
$1.3 \leq S < 2.1$	30	5	33	54	34(2)	158	8.914	17.7 ± 1.4	0.85 ± .08
$2.1 \leq S$	22	3	32	38	27	122	8.914	13.7 ± 1.2	0.70 ± .06

The counts given for the separate surveys are not corrected for incompleteness; the corrections are given in parentheses. Areas of surveys are **S4,** 0.4–0.5 Jy, 1.186 sr; above 0.5 Jy, 1.785 sr (including intermediate source survey); **S2** and **S3,** 2.036 sr; Parkes, 2.599 sr; Parkes fast surveys, 2.220 sr. The final column gives the counts normalized to an integral count $N_0 = 60\,S^{-1.5}$.

known sources, 93 were detected by the survey, as predicted by the calculation.

Strictly, this discussion applies only to sources with angular sizes small compared to the beamwidth of the 92-m telescope and it might be expected that the present survey tends to discriminate more against extended sources than the previous **S** surveys. Indeed one of the known sources missed by the survey (3C35) is heavily resolved by the telescope, but the result of the above comparison with a sample of known sources indicates that this effect is not serious, particularly for sources with flat radio spectra, which are of very small angular size.

e) *Optical Identifications*

A search was made on the Palomar Sky Survey prints for optical candidates in the vicinity of sources for which no previous identification had been reported, using the best available radio position. Generally, this was done only for sources having a flux density at 5 GHz greater than 0.5 Jy. The identification procedure for sources for which we measured interferometer positions has been described elsewhere (Kühr 1977) and was essentially the same for the other sources, except that a correspondingly larger region was searched for optical objects. For the present purpose, the identification was confined to classifying the object as a galaxy, a quasistellar object, or as lying in a blank field. For 123 **S4** sources with $S_{5\,\mathrm{GHz}} \geq 0.5$ Jy, suggested optical identifications are also available from the recent 966 MHz survey by Cohen *et al.* (1977).

IV. THE **S4** SURVEY RESULTS

The results of the survey and of the associated measurements (positions, flux densities, and optical identifications) are presented in Table III. This table contains all sources from the finding survey list which were confirmed by reobservation with the 100-m telescope and which lie in the area of 1.71 sr defined by $35° \leq \delta_{1950.0} < 70°$ and $|b| \geq 10°$. Although sources just outside this area are included in the list, they should be excluded from any statistical discussion. The data in Table III are as follows:

(a) Column 1 has the source name.

(b) Columns 2 and 3 have the 1950.0 coordinates.

(c) Column 4 has a code denoting the origin of the radio position. The same codes have been used as for the earlier **S** Surveys (Pauliny-Toth *et al.* 1972; Pauliny-Toth and Kellermann 1972b) with the following changes or additions:

(i) MP6 refers to a 100-m position measured at 5 GHz.

(ii) MP11 refers to a 100-m position measured at 2.7 GHz.

(iii) NR11 refers to a NRAO interferometer position measured at 2.7 and 8.1 GHz [present measurements, or measurements made by Condon (private communication)].

(d) Column 5 has the galactic latitude

(e) Columns 6 to 8 have the flux densities at 5 GHz, 2.7 GHz, and 10.7 GHz, headed by *S6, S11,* and *S3,* respectively. These are values obtained from the present measurements, unless otherwise stated in the footnotes to the table.

(f) Columns 9–12 contain the two-point spectral indices and their standard errors, obtained from the 2.7- and 5-GHz data (denoted by 11–6) and from the 5- and 10.7-GHz data (denoted by 6–3). The spectral index, α is defined by $S \propto \nu^{\alpha}$ and the quoted errors are calculated from the errors in the flux densities (Sec. III*b*).

(g) Column 13 contains the optical identification, the symbols used being the same as in the previous **S** surveys. Identifications based on the present work are indicated by a reference to a footnote in Column 14; others are taken from the literature. Identifications are only complete for sources having S (5 GHz) ≥ 0.5 Jy.

(h) Column 14 has references to footnotes following the Table, and finally

(i) Column 15 contains membership in other catalogues, in the manner of the previous surveys.

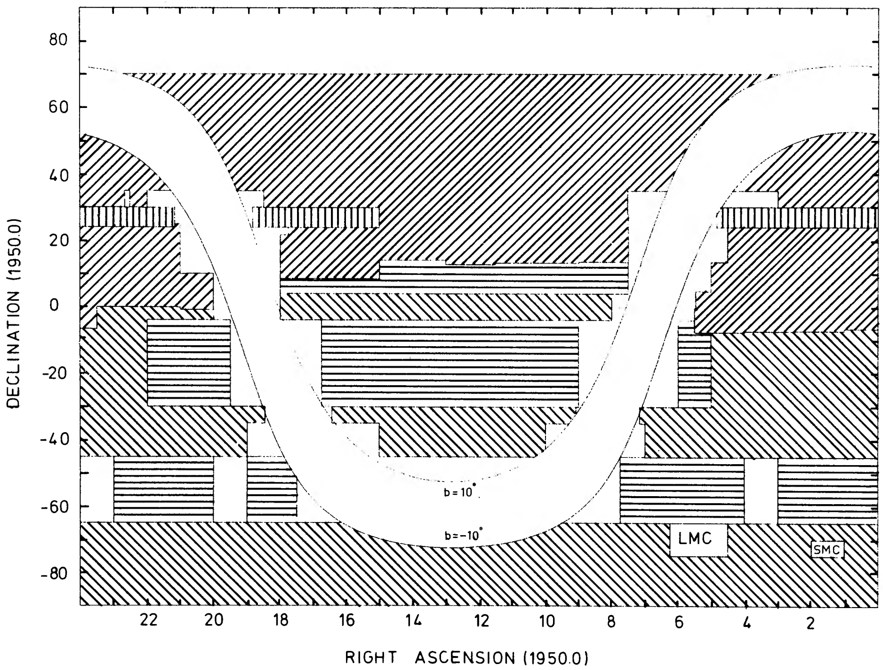

FIG. 2. Schematic representation of the regions of sky covered by the **S** surveys and by the Parkes survey areas used to obtain 5-GHz counts. Diagonal hatching represents the **S** survey and Parkes areas which give counts complete to 0.6 Jy. Vertical hatching represents the **S1** survey, complete to 0.8 Jy, and horizontal hatching the Parkes fast survey areas, essentially complete to 0.96 Jy. The Parkes regions between Dec. −45° and −65°, RA 3–4 h, 19–20 h, and 23–24 h, were excluded because of incompleteness in the 5 GHz data.

V. DISCUSSION

The source counts, spectral index distribution and identification content of the present **S4** survey and of other 5-GHz surveys have been discussed elsewhere (Pauliny-Toth 1976). Since that discussion was based partly on preliminary data and did not include all of the data now available, or all the necessary corrections (e.g., for incompleteness), some revised results are presented here.

a) *The Source Counts*

Table IV gives the counts for the **S4** survey. The corrections for incompleteness discussed in Sec. III*d* have been approximated by adding 7, 5, 2, and 2 sources, respectively, to the observed counts in the four lowest ranges of flux density. In addition, sources having flux densities $S_{5\ \mathrm{GHz}} \geq 0.5$ Jy from the "intermediate" source survey (Pauliny-Toth *et al.* 1972), which covers a strip of 0.074 sr adjacent in declination to the **S4** survey, have been added to the source counts. With this addition, the **S4** survey covers 1.186 sr in the flux density range $0.4 \leq S_{5\ \mathrm{GHz}} < 0.5$ Jy and 1.785 sr for $S_{5\ \mathrm{GHz}} \geq 0.5$ Jy.

The source counts for the previous **S** surveys are also shown in Table IV. The present **S4** survey overlaps part of the **S3** survey and sources in the area of overlap have been removed from the data given for the **S3** survey.

Additional data of similar sensitivity are provided by the Parkes 2.7-GHz surveys. Several of these surveys are essentially complete for flux densities $S_{2.7\ \mathrm{GHz}} \geq 0.22$ Jy (Wall *et al.* 1971; Shimmins 1971; Shimmins and Bolton 1972b and 1974; Bolton and Shimmins 1973; Bolton and Butler 1975; Wall *et al.* 1976) and flux densities for almost all sources found in these surveys which have $S_{2.7\ \mathrm{GHz}} \geq 0.35$ Jy have been measured at 5 GHz (above references or Shimmins and Bolton 1972a; Shimmins *et al.* 1969). From the spectral index distribution between 2.7 and 5 GHz and the fact that the Parkes surveys are believed to be complete above 0.35 Jy, the completeness of a 5-GHz sample based on these surveys can be determined. For $S_{5\ \mathrm{GHz}} \geq 0.6$ Jy, such a sample should be more than 99% complete. Excluding areas of overlap with the **S** surveys, areas with $|b| < 10°$, areas where the 5-GHz data were incomplete and areas around the Magellanic clouds, these surveys provided a further sample of 302 sources having $S_{5\ \mathrm{GHz}} \geq 0.6$ Jy, in a solid angle of 2.599 sr.

In addition, the Parkes 2.7-GHz fast surveys (Bolton *et al.* 1975; Wall *et al.* 1975; Shimmins *et al.* 1975) have been used in a similar manner to derive a 5-GHz sample for the stronger sources ($S_{5\ \mathrm{GHz}} \gtrsim 1$ Jy). A comparison of the area of overlap between these fast surveys and the **S** surveys shows that a 5-GHz sample based on the former is about 90% complete in the range $0.96 \leq S_{5\ \mathrm{GHz}} < 1.3$ Jy and 94% complete for $1.3 \leq S_{5\ \mathrm{GHz}} < 2.1$ Jy. These surveys provide a further sample of 101 sources having $S_{5\ \mathrm{GHz}} \geq 0.96$ Jy, in an area of 2.22 sr. The source counts for both sets of Parkes surveys are given in Table IV, as well as the combined counts for all the strong source samples.

The area for which 5-GHz source counts are available down to a flux density of 0.6 Jy covers a solid angle of 6.42 sr and includes 771 sources actually detected. The corresponding area for which counts are available above 0.96 Jy is 8.91 sr and contains 471 sources. Thus, 62% and 86% of the sky at galactic latitude $|b| \geq 10°$ are covered by the respective samples and no significant

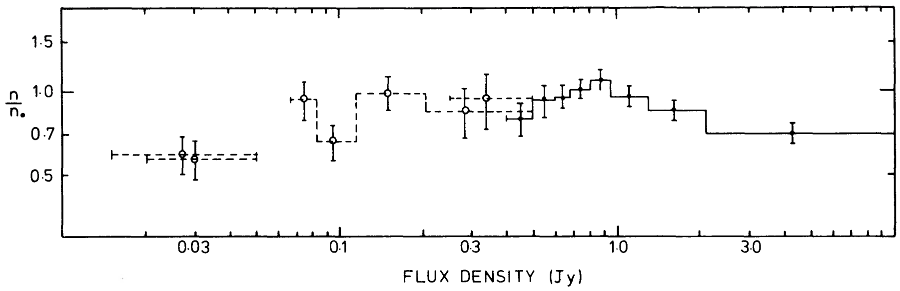

FIG. 3. Differential, normalized source counts at 5 GHz. Dots and solid lines represent combined S survey and Parkes data, circles and dashed lines are from the "intermediate" survey (Pauliny-Toth *et al.* 1972), the survey by Davis (1971) and two deep surveys with the 100-m telescope (Pauliny-Toth *et al.*, 1978a, 1978b) The counts are normalized to $N_0 = 60S^{-1.5}$.

reduction in the statistical uncertainties is to be expected from an extension of the surveys to the whole area at $|b| \geq 10°$. Figure 2 shows the regions of sky covered by the various strong source surveys.

The source counts are extended to higher source densities by several surveys of limited areas of sky, down to limiting flux densities as low as 0.015 Jy (Pauliny-Toth *et al.* 1972; Davis 1971; Pauliny-Toth *et al.* 1978a and 1978b). The composite, differential source counts, normalized to a uniform, static Euclidean model with an integral count $N_0 = 60\ S^{-1.5}$, are shown in Fig. 3. The flux-density intervals within each survey have been chosen so that this model should give roughly equal numbers of sources in each interval.

The most striking feature of the 5-GHz counts shown in Fig. 3 is their extreme flatness over a wide range of flux density. By contrast, the counts observed at long wavelengths are characterized by a steep gradient for the stronger sources, which gradually decreases with decreasing flux density (e.g., Jauncey 1975). At 408 MHz, for example, the differential counts, normalized to a model with a differential count $n_0 \propto S^{-2.5}$, show a slope of -0.3 for source densities below 10 sr^{-1}, a slope close to zero near 100 sr^{-1} and converge rapidly with a slope of about +1 for source densities above 10^3 sr^{-1}.

If all sources had the same spectral index, the form of the counts would be independent of frequency, except for a shift in the flux density scale. The 5-GHz surveys, however, contain roughly equal numbers of sources with flat [$\alpha \sim 0$ (where the spectral index α is defined by $S \propto \nu^{\alpha}$)] and steep ($\alpha \sim -0.8$) spectra, so that the source count at any particular flux density is a superposition of the long-wavelength counts over a wide range of flux densities. The range of spectral indices observed at 5 GHz corresponds to a range of more than 10^3 in the flux density at 408 MHz. For a flux density $S_{5\ \mathrm{GHz}} = 1$ Jy, characteristic of the S surveys, the steep spectrum sources have flux densities of about 10 Jy at 408 MHz, where the slope of the normalized counts is ~ -0.3; the flat-spectrum sources, on the other hand, have flux densities at 408 MHz of about 1 Jy, where the slope is ~ 0. Since the fraction of sources with flat spectra is independent of flux density at 408 MHz (Pauliny-Toth and Kellermann 1972a), the flat-spectrum sources in the S surveys will show a slope of the normalized counts of ~ 0, while the steep spectrum sources will show a steeper slope, as is in fact observed (Pauliny-Toth and Kellermann 1972b; Condon and Jauncey 1974). We note in this respect, that the low value of $\langle V/V_m \rangle$ obtained for QSS with flat spectra (Schmidt 1976, Kühr and Schmidt 1977; Wall *et al.* 1976) also refers to the portion of the 408 MHz counts where the normalized slope is close to zero. The difference between the $\langle V/V_m \rangle$ values for QSS with flat and steep radio spectra may thus reflect the different volumes of space selected by these samples, rather than a difference in their evolution.

Over the narrower frequency range of 5 GHz to 2.7 GHz, this effect should be less marked and this is the case when sources with flat ($\alpha \geq -0.5$) and steep ($\alpha < -0.5$) spectra in this frequency range are considered separately. A formal fit of the relation $N(S) = KS^x$ to the counts for the two spectral classes for $S_{5\ \mathrm{GHz}} \geq 0.6$ Jy by the method of maximum likelihood (Crawford *et al.* 1970) gives the results summarized in Table V, and the normalized, differential counts are shown in Fig.

TABLE V. Number-flux relation for $S_{5\ \mathrm{GHz}} \geq 0.6$ Jy for all sources and for flat- and steep-spectrum sources

Sample	K	x	N
All sources	51.4 ± 1.6	−1.67 ± .06	771
Flat spectra	28.4 ± 1.1	−1.60 ± .08	410
Steep spectra	22.9 ± 1.1	−1.76 ± .09	360

Flat and steep spectra are defined by α(5-2.7 GHz) ≥ -0.5 and < -0.5, respectively. For one source in the total sample, no 2.7 GHz data are available.

TABLE VI. Number-flux relation and median spectral index for sources having $S_{5\ \mathrm{GHz}} \geq 0.6$ Jy in areas defined by supergalactic coordinates.

	Region	K	x	N	$\bar{\alpha}$
I	$\lvert B \rvert < 60°$, $L = L_c - 45°$–$L_c + 45°$	42.2 ± 3.2	−2.02 ± .15	187	−.51 ± .07
II	$\lvert B \rvert < 60°$, $L = L_c + 45°$–$L_c + 135°$	49.8 ± 4.0	−1.52 ± .16	97	−.36 ± .12
III	$\lvert B \rvert < 60°$, $L = L_c + 135°$–$L_c + 225°$	55.0 ± 2.7	−1.56 ± .10	261	−.44 ± .06
IV	$\lvert B \rvert < 60°$, $L = L_c + 225°$–$L_c + 315°$	56.6 ± 3.5	−1.56 ± .12	170	−.41 ± .08
Combined regions II-IV		54.3 ± 1.9	−1.56 ± .07	528	−.42 ± .05

L,B refer to supergalactic coordinates, with the pole (b , 90°) at galactic coordinates l = 47°, b = 6°; L_c is the direction of the center of the system, at l = 283°, b = 75° (Virgo cluster direction). The median spectral index $\bar{\alpha}$ and its error are as in Table VII.

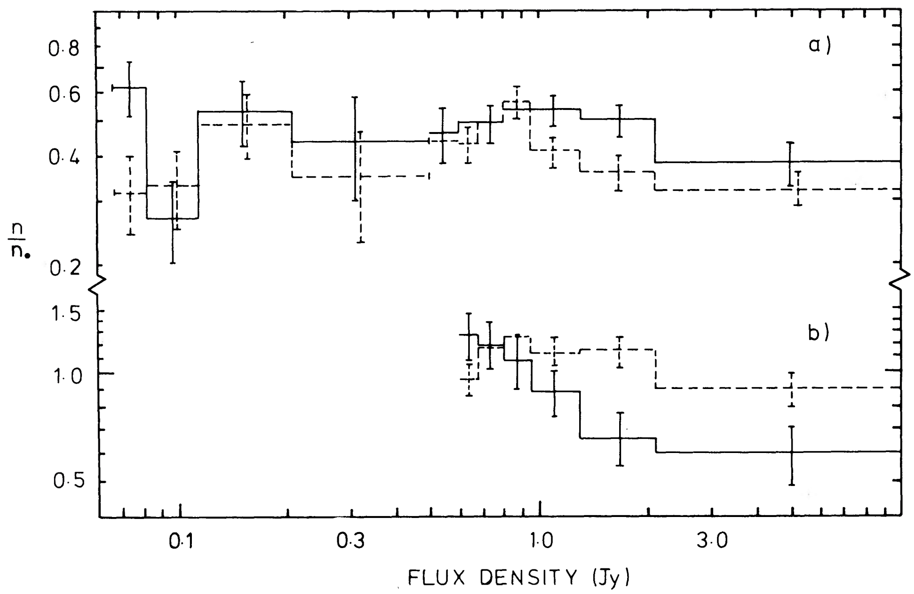

FIG. 4. Differential, normalized source counts at 5 GHz for (a) sources with flat spectra i.e., $\alpha_{5.0}^{2.7} \geq -0.5$ (solid line), and sources with steep spectra i.e., $\alpha_{5.0}^{2.7} < -0.5$ (dashed). (b) two areas defined by coordinates in supergalactic system. Solid line, area extending ±60° in latitude, ±45° in longitude centered on the system center (Region I of table VI), dashed line, same latitude range, all other longitudes (Regions II–IV of Table VI).

4(a). The counts for the two spectral classes differ by only 1σ above 0.6 Jy. Below this flux density, the slope of the normalized counts is close to zero for both spectral classes.

A further feature of the 5 GHz source counts is the apparent anisotropy in the angular distribution of the sources in the sky. It has previously been reported that the slope of the source counts for the stronger sources ($S_{5\text{ GHz}} \geq 0.6$ Jy) is steeper in the north than in the south galactic hemisphere (Pauliny-Toth and Kellermann 1972b; Yahil 1972), and that the effect was present in all the **S** surveys, but not the Parkes surveys (Pauliny-Toth 1976). We have examined the effect further by determining the source counts for various areas in the supergalactic coordinate system (de Vaucouleurs 1958). It appears that the source counts for the strong source sample show a steep slope only in an area of about 1.6 sr centered on the direction of the center of this system; elsewhere, the slope does not differ significantly from that expected for a uniform spatial distribution of sources when the effects of space curvature and redshift are small. These results are illustrated in Fig. 4(b) and the results of the fit of the expression $N(S) = KS^{x}$ to the counts are summarised in Table VI.

We do not consider these results as being necessarily strong evidence for anisotropy, although it should be noted that the nearby Virgo and Coma clusters lie within the region showing the steep slope. We note, however, that the departure of the source counts for the whole sample from those expected for a uniform spatial distribution is smaller than the apparent deviations from a uniform angular distribution.

b) Spectra and Identifications

As in the previous **S** surveys, approximately half of all the sources detected in the **S4** survey have the flat, or inverted spectra characteristic of compact, self-absorbed synchrotron sources. Table VII summarizes the statistics of the distribution of the two-point spectral index $\alpha_{5.0}^{2.7}$ (where the suffixes denote the two frequencies, in GHz, used to determine α) for different identification classes

TABLE VII. Distribution of the two-point spectral index between 5 and 2.7 GHz for various source classes.

Source class	Median index $\bar{\alpha}$	Fraction with $\alpha \geq 0.5$	Number of sources	Samples
All sources	−0.43 ± 0.04	0.53 ± 0.02	895	All S,P,Pf
QSS	−0.11 0.03	0.76 0.06	192	**S2,S3,S4**
GAL	−0.71 0.03	0.29 0.04	167	**S2,S3,S4**
EF	−0.51 0.08	0.49 0.07	104	**S2,S3,S4**
$.067 \leq S < .6$	−0.45 0.04	0.49 0.06	144	D($\lvert b \rvert \geq 10°$)
$.5 \leq S < .6$	−0.52 0.11	0.48 0.09	58	**S4**
$.6 \leq S < .8$	−0.47 0.05	0.50 0.04	278	**S2,S3,S4,P**
$.8 \leq S < .96$	−0.54 0.08	0.48 0.06	146	All S,P
$.96 \leq S < 1.3$	−0.36 0.10	0.56 0.05	192	All S,P,Pf
$1.3 \leq S < 2.1$	−0.30 0.11	0.58 0.06	157	All S,P,Pf
$2.1 \leq S$	−0.43 0.09	0.54 0.07	122	All S,P,Pf

The error in $\bar{\alpha}$ is the mean of the ranges on each side of the median which contain $\sqrt{N}/2$ sources. In the final column, P refers to the Parkes data, Pf to the Parkes fast survey data and D to the deep survey by Davis (1971). The first four samples are defined by $S_{5\text{ GHz}} \geq 0.6$ Jy.

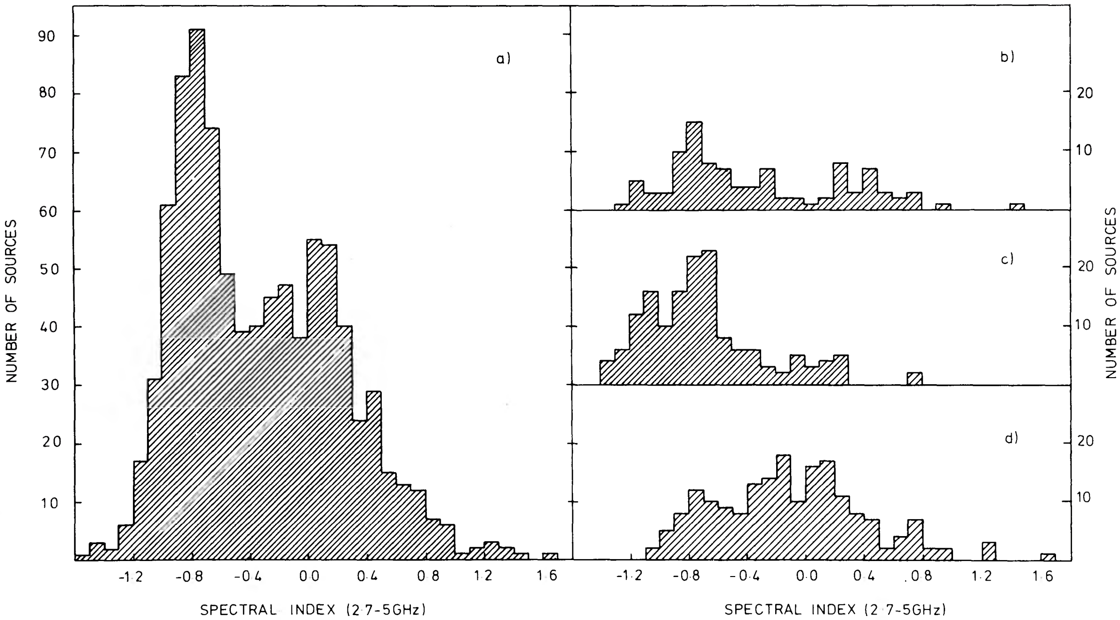

FIG. 5. Distribution of the two-point spectral index $\alpha_{5.0}^{2.7}$ for sources having $S_{5\ \mathrm{GHz}} \geq 0.6$ Jy are given (a) for all sources in the S and Parkes survey samples, (b) for sources lying in empty fields, (c) for sources identified with galaxies, (d) for sources identified with quasars. For the last three samples, data are from S surveys only.

and for several ranges of the 5-GHz flux density. In the latter case, the Parkes samples have been included and the spectral statistics for the deep 5-GHz survey (Davis 1971), taken from Pauliny-Toth *et al.* (1974), are given for comparison.

Table VII shows that there is no significant variation in the median spectral index, or in the fraction of sources with flat spectra, with the flux density. This is, of course, consistent with the similar form of the source counts for sources with flat or steep spectra in the range 5–2.7 GHz. But when the low-frequency spectral index is determined from data at 5 GHz and 408 or 318 MHz (Pauliny-Toth and Kellermann 1972b; Condon and Jauncey 1974) it becomes more negative (i.e., the median spectrum steepens) with decreasing flux density.

Figure 5 shows the distribution of the spectral index $\alpha_{5.0}^{2.7}$ for the complete sample and also separately for sources identified with QSS, galaxies, and those associated with empty fields. The overall distribution is double peaked, with a narrow peak near $\alpha = -0.8$, which is due largely to the galaxies and a broader peak near $\alpha = 0$, due largely to the QSS. The empty field sources show a distribution intermediate between those of the QSS and the galaxies, corresponding to a mixture of about 55% galaxies and 45% QSS. By contrast, in low-frequency surveys, the empty field sources have spectra similar to those of radio galaxies (Bolton 1966; Pauliny-Toth and Kellermann 1968).

Although most of the sources with flat spectra are quasars, a significant fraction ($\sim$16%) are galaxies. Radio galaxies of this type generally contain a compact, self-absorbed source at the galactic nucleus, which contributes a significant fraction of the total flux density at centimeter wavelengths.

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